



COURSE CARD

1. Basic information

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|--|--|-------------------------------------|
| Course name in English: | Mini-kompedium of Classical Theoretical Physics | |
| Course name in Polish: | Mini-kompedium klasycznej fizyki teoretycznej | |
| Number of hours: | 30 | |
| Type of course: | Elective course | |
| Form of course: | lecture | |
| Code of course: | W11NAF-SD0076W / NFQ100372W | |
| Course leader: | prof. dr hab. Antoni C. Mituś | |
| Faculty of the course leader: | W11 Faculty of Fundamental Problems of Technology | |
| Email address of the course leader: | antoni.mitus@pwr.edu.pl | |
| Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course): | Architecture and urban planning | <input type="checkbox"/> |
| | Automation, electronic, and electrical engineering | <input type="checkbox"/> |
| | Information and communication technology | <input type="checkbox"/> |
| | Biomedical engineering | <input type="checkbox"/> |
| | Chemical engineering | <input type="checkbox"/> |
| | Civil engineering and transport | <input type="checkbox"/> |
| | Mechanical engineering | <input type="checkbox"/> |
| | Environmental engineering, mining, and energy | <input type="checkbox"/> |
| | Mathematics | <input checked="" type="checkbox"/> |
| | Chemical sciences | <input type="checkbox"/> |
| | Physical sciences | <input checked="" type="checkbox"/> |
| | Management and quality studies | <input type="checkbox"/> |

2. Objectives

C1 Overview of methodology and basic concepts and formulas in physics based on Landau Lifshitz course of theoretical physics

C2 Solving typical problems from Landau Lifshitz course of theoretical physics

3. Content

Detailed information about the course content, including topics and form of classes.

| No. | Topic | Number of hours | Form of classes |
|-----|--|-----------------|-----------------|
| 1 | Principle of least action, Lagrange equations, symmetries and conservation laws | 2 | lecture |
| 2 | Integration of equations of motion | 2 | lecture |
| 3 | Dynamics of a rigid body (Euler's equations) | 1 | lecture |
| 4 | Hamilton and Hamilton-Jacobi equations. Canonical transformations, conservation laws | 3 | lecture |



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| 5 | Charge in electromagnetic field | 2 | lecture |
| 6 | Equations of electromagnetic field | 2 | lecture |
| 7 | Constant electromagnetic field | 2 | lecture |
| 8 | Electromagnetic waves | 2 | lecture |
| 9 | Electromagnetic radiation | 2 | lecture |
| 10 | Basic concepts of statistics | 2 | lecture |
| 11 | Basic concepts of thermodynamics | 2 | lecture |
| 12 | Gibbs distribution. Phase equilibrium | 2 | lecture |
| 13 | Fluctuations | 2 | lecture |
| 14 | Phase transitions | 2 | lecture |
| 15 | Hydrodynamics: continuity equation, Euler's equation, Bernoulli and Navier-Stokes equations | 2 | lecture |

4. Prerequisites

List of prerequisites relating to knowledge, skills and other competences for course participants.

1. Theoretical physics according to technical university study programme
2. Mathematical analysis according to technical university study programme

5. Learning outcomes

List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

| Symbol | Learning outcome | |
|--------|---|-------------------------------------|
| | <i>KNOWLEDGE. Doctoral student knows and understands:</i> | |
| SzD_W3 | the main trends in the development of the scientific or artistic disciplines covered in the curricula; | <input type="checkbox"/> |
| SzD_W4 | research methodology; | <input checked="" type="checkbox"/> |
| SzD_W5 | the rules for the dissemination of scientific results, including in open access mode; | <input type="checkbox"/> |
| SzD_W6 | the fundamental dilemmas of modern civilization; | <input type="checkbox"/> |
| SzD_W7 | the legal and ethical conditions of scientific activity; | <input type="checkbox"/> |
| SzD_W8 | the economic and other relevant conditions of scientific activity; | <input type="checkbox"/> |
| SzD_W9 | basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results. | <input type="checkbox"/> |
| | <i>SKILLS. Doctoral student is able to:</i> | |
| SzD_U2 | use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular: - define the purpose and subject of scientific research, formulate a research hypothesis, - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; | <input checked="" type="checkbox"/> |



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| | critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres; | |
| SzD_U3 | communicate on specialised topics to the extent that they enable an active participation in the international scientific community; | <input type="checkbox"/> |
| SzD_U4 | disseminate research results, including in popular forms; | <input type="checkbox"/> |
| SzD_U5 | initiate debates and participate in a scientific discourse; | <input type="checkbox"/> |
| SzD_U6 | be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment; | <input type="checkbox"/> |
| SzD_U7 | plan and implement an individual or collective research or creative activity, including in an international environment; | <input type="checkbox"/> |
| SzD_U8 | independently plan and act for one's own development and inspire and organize the development of others; | <input type="checkbox"/> |
| SzD_U9 | plan classes or groups of classes and implement them using modern methods and tools. | <input type="checkbox"/> |
| | <i>SOCIAL COMPETENCES. Doctoral student is ready to:</i> | |
| SzD_K3 | fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way; | <input checked="" type="checkbox"/> |
| SzD_K4 | maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection. | <input type="checkbox"/> |

6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

Exam: written summary of the course and oral discussion

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

N1. Lecture

N2. Active discussion during the lecture

8. Literature

List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.

- [1] L.D. Landau, E.M Lifszyc, *Mechanika*, PWN, 2014
- [2] L.D. Landau, E.M Lifszyc, *Teoria pola*, PWN, 2011
- [3] L.D. Landau, E.M Lifszyc, *Fizyka statystyczna część 1*, PWN, 2011
- [4] L.D. Landau, E.M Lifszyc, *Hydrodynamika*, PWN, 2011



9. Other remarks

Additional remarks, comments, (e.g., language of the course)