# Vibrations and waves - course description

## General information

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| Course name | Vibrations and waves |
| Course ID | 13.2-WF-FizP-VW-S17 |
| Faculty | Faculty of Physics and Astronomy |
| Field of study | Physics |
| Education profile | academic |
| Level of studies | First-cycle studies leading to Bachelor's degree |
| Beginning semester | winter term 2019/2020 |

## Course information

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| Semester | 3 |
| ECTS credits to win | 3 |
| Available in specialities | General physics |
| Course type | obligatory |
| Teaching language | english |
| Author of syllabus | • dr hab. Bohdan Padlyak, prof. UZ |

## Classes forms

| The class form | Hours per semester (full-time) | Hours per week (full-time) | Hours per semester (part-time) | Hours per week (part-time) | Form of assignment |
|---|---|---|---|---|---|
| Lecture | 30 | 2 | - | - | Credit with grade |

## Aim of the course

Understanding of phenomena and physical processes in nature, related to vibrations and waves. Definitions and determination of physical quantities and parameters of vibration and waves. Mathematical description of vibration and mechanical and electromagnetic waves. Calculation of vibration and wave motion parameters.

## Prerequisites

Knowledge of physics and mathematics in high school courses. Basic quantities, phenomena and physical laws. Algebraic and geometric methods in physics including vector calculus and the basis of differential and integral calculus.

## Scope

1) Harmonic vibrations. Examples of harmonic vibrations (mathematical and physical pendulum). Harmonic vibrations free and dampened. Forced vibrations and resonance phenomenon.

2) Classical wave equation. Solutions in the form of harmonic standing waves and running waves.

3) Waves in the elastic media and elements of acoustic. Basic properties of waves (wave equation, wave propagation velocity, formation and propagation of sound waves). Propagation of energy in wave motion. Doppler effect.

4) Electromagnetic vibrations. Electrical alternating current. The LC and RLC circuits. The Maxwell's laws.

5) Electromagnetic waves. Spectrum range (scale) and sources of electromagnetic waves. The energy of electromagnetic waves. The Poynting vector.

6) Interference and diffraction phenomena for mechanical and electromagnetic waves. Comparison of the properties of electromagnetic and mechanical waves.

7) Geometric optics. The laws of geometric optics (reflection and refraction of light). Simple optical instruments (lenses, prisms). The limits of the applicability of geometric optics.

8) Wave optics. Polarization of light. Natural and enforced birefringence.

9) Wave properties of light (dispersion, diffraction, and interference).

10) Waves of matter (the De-Broglie hypothesis, atomic structure and standing waves, wave mechanics).

## Teaching methods

Conventional lecture. Working with a book.

## Learning outcomes and methods of theirs verification

| Outcome description | Outcome symbols | Methods of verification | The class form |
|---|---|---|---|
| He is aware of his knowledge and skills, understands the need and knows the possibilities of continuing education (second and third degree studies, postgraduate studies) - raising professional and personal competences. | • K1A_K01 | • an evaluation test<br>• an exam - oral, descriptive, test and other | • Lecture |

| Outcome description | Outcome symbols | Methods of verification | The class form |
|---|---|---|---|
| He is able to analyze and solve problems in the physical sciences based on acquired knowledge and information from available bibliographic sources, databases, web resources both in Polish and foreign languages. | • K1A_U01 | • an evaluation test<br>• an exam - oral, descriptive, test and other | • Lecture |
| He has general knowledge in classical physics and modern physics, physical measurement methodology and astronomy, which allows him to understand the basic physical phenomena of the surrounding world and knows their causally-effect relationship. | • K1A_W01 | • an evaluation test<br>• an exam - oral, descriptive, test and other | • Lecture |

## Assignment conditions

Lecture Examination: Passing a positive (written or oral) examination in the entire material range.

## Recommended reading

[1] D. Halliday, R. Resnick, J. Walker, Fundamentals of Physics, Parts 2 and 4, John Wiley & Sons Inc., 2001.

[2] F.S. Crawford Jr., Waves: Berkeley Physics course, Vol. 3, McGraw-Hill, 1968.

## Further reading

[1] F.S. Crawford, Waves and Oscillations: Berkeley Physics Course, Vol. 3, McGraw-Hill, 1966.

[2] H.J. Pain, The Physics of Vibrations and Waves, John Wiley & Sons Ltd, 2005.

## Notes

Modified by dr hab. Piotr Lubiński, prof. UZ (last modification: 20-02-2020 12:06)