BACHELOR'S PROGRAMME
1st YEAR OF STUDY, 2nd SEMESTER

| COURSE TITLE | OSCILLATIONS AND WAVES |
|---|---|
| COURSE CODE | |
| COURSE TYPE | full attendance |
| COURSE LEVEL | 1st cycle (bachelor's degree) |
| YEAR OF STUDY, SEMESTER | 1st year of study, 2nd semester |
| NUMBER OF ECTS CREDITS | 6 |
| NUMBER OF HOURS PER WEEK | 5 (2 lecture hours + 3 seminar/laboratory hours) |
| NAME OF LECTURE HOLDER | Assoc. prof. dr. Sebastian POPESCU |
| NAME OF LABORATORY HOLDER | Asist. dr. Alexandru LUKACS |
| PREREQUISITES | Advanced level of English |

## A PROFESSIONAL AND TRANSVERSAL COMPETENCES

**Professional competences:**

- Identifying the basic concepts of mechanics.
- Explaining the structure and operation of the components of different types of equipment using specific theories and tools (diagrams, mathematical and physical models, etc.).
- Description of the modeling methods of physical phenomena using notions and theories specific to physical and mathematical modeling.
- Explaining and interpreting physical phenomena and operationalizing key concepts based on the appropriate use of laboratory equipment.
- Critical evaluation of the results of the experiment, including the degree of uncertainty of the obtained experimental results.

**Transversal competences**:

- Identifying roles and responsibilities in a team and applying effective communication and work techniques within the team.
- Effective utilization of learning and communication resources and techniques for your own development.

## B LEARNING OUTCOMES

Upon successful completion of this discipline, students will be able to:

- Explain the structure and operation of the components of different types of equipment using specific theories and tools (diagrams, mathematical and physical models, etc.).
- Describes the methods of modeling physical phenomena using notions and theories specific to physical and mathematical modeling.
- Use specific measuring instruments, as well as the mathematical apparatus necessary for the description of mechanical phenomena.
- Analyze mechanical phenomena and extract relevant information for the development of associated mathematical models.
- Calculate the functional expressions and the values of the physical quantities of interest, which can be evaluated based on the developed physical models.

## C LECTURE CONTENT

Elastic properties of bodies.
Mechanical balance of bodies. Stability of mechanical balance.
Free oscillations. Composition of parallel oscillations. Composition of perpendicular oscillations.
Damped oscillations. Characteristic sizes.
Forced oscillations. Amplitude resonance. Resonance of energy. Quality factor of an oscillator.
Coupled oscillators. Normal modes of oscillation, natural frequencies.
Propagation of disturbances in an elastic medium. Transverse waves and longitudinal waves. Characteristic quantities of waves. The wave equation and its solution.
Wave absorption. Wave dispersion. Phase speed. Group speed.
Reflection and refraction of elastic waves. Fresnel's formulas.
Interference and diffraction of waves.
Elements of acoustics and ultra-acoustics (sound waves, sound strings and tubes, Doppler effect, sound qualities, ultrasound).

## D RECOMMENDED READING FOR LECTURES

1. H. D. Young, R. A. Freedman, "Sears & Zemansky's University Physics", 15th edition, Pearson Education Ltd, 2019
2. http://newton.phys.uaic.ro

## E LABORATORY/SEMINARS CONTENT

Elastic properties of bodies
Mechanical equilibrium of bodies and stability of mechanical equilibrium
Mechanical oscillations (free, damped and forced)
Composition of oscillations, Fourier analysis
Elastic waves (specific properties, reflection, refraction, interference, diffraction, dispersion, absorption)

| | | |
|---|---|---|
| | Acoustics (Sound waves, sound qualities, sound strings and tubes, ultrasound) | |
| F | **RECOMMENDED READING FOR LABORATORY/SEMINARS** | |
| | 1. H. D. Young, R. A. Freedman, "Sears & Zemansky's University Physics", 15th edition, Pearson Education Ltd, 2019<br>2. http://newton.phys.uaic.ro | |
| G | **EDUCATION STYLE** | |
| LEARNING AND TEACHING METHODS | | Lecture, guided discovery, debate, problem solving |
| ASSESSMENT METHODS | | • Weekly homework<br>• Exam: Oral and Written test |
| LANGUAGE OF INSTRUCTION | | English |