

# ...PHYSICS...I.

(Environmental engineering, 1<sup>st</sup> Year of study, 1<sup>st</sup> Semester)

**Credits (ECTS): 5**

**Course category: Core discipline (mandatory)**

**Course holder: Lecturer Ilie BODALE, PhD**

## **Objectives of the discipline:**

The discipline objectives consist in study of biophysics and agrometeorology knowledge to understand the fundamental mechanisms underlying the development of living organisms, studied within the specialized disciplines.

## **Contents (syllabus)**

<b>Course (chapters/subchapters)</b>
<b>1. Introduction</b> 1.1 Vectors and scalars 1.2 Reference system. 1.3 Rigid-body dynamics 1.4 The material point.
<b>2. Kinematics</b> 2.1 Speed and acceleration. 2.3 The movement of bodies in the gravitational field. 2.3 Laws of motion
<b>3. The principles of dynamics</b> 3.1 The principles of dynamics 3.2 Momentum and conservation of momentum. 3.3 Kinetic momentum and conservation of kinetic momentum. Applications. 3.4 Mechanical work and mechanical power. 3.5 Kinetic and potential energy. The law of conservation of mechanical energy.
<b>4. Oscillations and mechanical waves.</b> 4.1 Harmonic oscillations. 4.2 Damped oscillations. 4.3 Forced oscillations. 4.4 Mechanical resonance. 4.5 Sound and ultrasound. Effects of sounds and ultrasound on biological environments.

<p><b>5. Fluid dynamics and the laws of fluid dynamics</b></p> <p>5.1 Electrostatic pressure. Pascal's law</p> <p>5.2 Archimedes' laws</p> <p>5.3 Molecular phenomena at the surface of liquids (surface layer, surface tension). Applications in nature and engineering.</p> <p>5.4. Molecular phenomena at the liquid-solid-gas contact (capillarity, adsorption and absorption). Applications in nature and engineering.</p> <p>5.5. Molecular transport phenomena (viscosity, simple diffusion, osmosis). Applications in nature and engineering.</p>
<p><b>6. Electrostatics</b></p> <p>6.1 Electric field lines. Interactions between electric charges</p> <p>6.2 Electric field intensity, electric potential, capacitors, voltage sources.</p> <p>6.3 Gauss's law.</p>
<p><b>7. Electrokinetic</b></p> <p>7.1 Continuous electric current. Laws of direct current through conductors and circuits.</p> <p>7.2 Alternating electric current. Alternating current circuits.</p>
<p><b>8. Methods of producing electric current</b></p> <p>8.1 Transformation of mechanical energy into electrical energy. Electrical induction.</p> <p>8.2 Electric current generators.</p> <p>8.3 The Steebeck effect. Electric file.</p>
<p><b>9. Electromagnetism</b></p> <p>9.1 Electromagnetic waves.</p> <p>9.2 The effect of electromagnetic waves on organisms. Applications.</p>

Practical activity
<p><b>1. Introduction</b></p> <p>1.1 Presentation of the objectives and working methodology in the laboratory</p> <p>1.2 Labor protection measures in the laboratory.</p> <p>1.3 Processing of measured data.</p> <p>1.4. Notions of error calculation.</p> <p>1.5 Mathematical operators used in physics. Applications</p>
<p><b>2. The study of accelerated uniform rectilinear motion</b></p> <p>2.1 Determining motion graphs for x and v</p> <p>2.2 Determination of acceleration</p>
<p><b>3. Determination of mechanical properties of solids</b></p> <p>3.1 Elastic constant of a spring</p> <p>3.2 Resistance to deformation and shear</p>
<p><b>4. Determination of properties of liquids</b></p> <p>4.1 The dynamic viscosity coefficient of liquids using the Oswald viscometer and the Stokes's method.</p> <p>4.2 The surface tension coefficient of liquids using the Traube stalagmometer</p>
<p><b>5. Study of the properties of electric current</b></p> <p>5.1 Electric circuits in direct and alternating current</p> <p>5.2 Electric power sources</p> <p>5.3 Generation of electric current by electromagnetic induction</p> <p>5.4 Electrical resistance and conductivity of a biological liquid using the Kohlrausch bridge.</p>

## 6. Characterization of non-linear physical phenomena

6.1 Fractal analysis of irregular surfaces

6.2 Modeling and simulation of non-linear phenomena

### Bibliography

1. Bodale I., 2023 – „Fizică. Mecanică. Electricitate. Optică”, Suport de curs USV Iași;
2. Cazacu A., Bodale I., Oancea S., 2021 – „Fenomene de transfer și operații unitare”, Iași, Ed. „Ion Ionescu de la Brad.
3. Oancea S., *Fizica elementara*, Editura PIM, Iasi, 2005
4. Bodale I., 2022 – „Referate pentru laboratorul de Fizică”, USV Iași.
5. Oancea S., Cazacu A., *Probleme rezolvate de fizică*, Editura PIM, Iasi, 201

### Evaluation

Evaluation form	Evaluation Methods	Percentage of the final grade
Final exam	Written examination	70 %
Evaluation of the activity during the semester	Written and oral assessments during the semester	30 %

### Contact

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# ...PHYSICS...II.

(Environmental engineering, 1<sup>st</sup> Year of study, 2<sup>nd</sup> Semester)

**Credits (ECTS): 3**

**Course category: Core discipline (mandatory)**

**Course holder: Lecturer Ilie BODALE, PhD**

## Objectives of the discipline:

The discipline objectives consist in study of the main physical phenomena within soil, water and air protection by students. Necessary knowledge for the advanced study of specialized subjects.

## Contents (syllabus)

Course (chapters/subchapters)
<b>1. Geometric optics</b> 1.1. The reflection. The laws of refraction. Applications. 1.2. Refraction of light. Total reflection. The laws of reflection. Applications.
<b>2. Optical devices</b> 2.1. Lenses, mirrors, microscopes, refractometer and human eye. 2.2. Construction of images through optical devices. Applications.
<b>3. Wave optics</b> 3.1. Light dispersion. Applications. 3.2. Interference of light. Young's device, interference in thin plates, Newton's rings, interferometers. Applications. 3.3. Diffraction of light. The diffraction grating. Applications. 3.4. Polarization of light. Applications.
<b>5. Spectral analysis methods</b> 5.1. The spectroscope. 5.2 VIS and UV spectrophotometer. 5.3 The photocalorimetry

Practical activity
1. The study of the formation of images by lenses.
2. Determination of the focal length of a thin lens.
3. Determination of the refractive index of a thin slide with the microscope.
4. Determination of fruit sugar concentration based on the refractive index of the juice, measured with the Abbe refractometer.
5. Determination of the sugar concentration of a solution with the Laurent polarimeter.
6. Determination of the thickness of thin wires with the goniometer.
7. Determination of chlorophyll content in leaves using the spectroscope.

## Bibliography

1. Bodale I., 2023 – „Fizică. Mecanică. Electricitate. Optică”, Suport de curs USV Iași;
2. Cazacu A., Bodale I., Oancea S., 2021 – „Fenomene de transfer și operații unitare”, Iași, Ed. „Ion Ionescu de la Brad.
3. Oancea S., 2005 – *Fizica elementara*, Editura PIM, Iasi,
4. Bodale I., 2022 – „Referate pentru laboratorul de optica”, USV Iași.
5. Oancea S., Cazacu A., 2015 – *Probleme rezolvate de fizică*, Editura PIM, Iasi.

## Evaluation

Evaluation form	Evaluation Methods	Percentage of the final grade
Final exam	Written examination	70 %
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