

**TEACHING DISCIPLINE: Biophysics (Specialization Agricultural Biotechnologies, 1<sup>st</sup> Year of study, 1<sup>st</sup> Semester)**

**Credit value (ECTS): 4**

**Course category: mandatory**

**Course holder:**

**Lecturer PhD. Ana CAZACU**

**Discipline objectives (course and practical works)**

The aim of the course is to give students a basic insight into the theoretical and practical knowledge about the physical phenomena occurring in living systems and their influence on the evolution of organisms.

The practical work aims to develop students' capacities for conducting experimental measurements and interpret the data. Furthermore, it aims to raise awareness of proper handling of experimental devices and develop the creativity in order to form specialists.

**Contents (syllabus)**

<b>Course (chapters/subchapters)</b>
<b>Biophysics:</b> subject, methods of study and historical evolution; research domains.
<b>Biological fluids:</b> fluids, generalities, main characteristics of biological liquids; water and its properties.
<b>Molecular phenomena in liquids:</b> surface tension, capillarity, viscous fluids, Newton's law, liquid flow through tubes, laminar and turbulent flow, notions of hemodynamics.
Diffusion, laws of diffusion, osmosis and osmotic pressure, the osmotic pressure of biological fluids.
<b>Biological membranes:</b> membrane biophysics, cell membrane functions, types of transport through the cell membrane, passive transport, active transport.
<b>Thermodynamics of biological processes:</b> thermodynamic system, the parameters of a thermodynamic system, biological system, the zeroth and first law of thermodynamics, energy conversion, application of the first law, simple thermodynamic processes, the second law of thermodynamics and applications, irreversible processes, the irreversibility of biological processes and implications for living organisms.
<b>Analyzers.</b> Visual analyzer: the eye as an optical system; biophysics of vision. Auditory analyzer: the inner ear, biophysics of hearing, ultrasounds and their use.
<b>Notions of radiation biophysics:</b> electromagnetic waves spectrum; physical characteristics of the electromagnetic waves; the action of Vis, UV and IR radiations on organisms; natural and artificial radioactivity; radioactive isotopes; the action of ionizing radiation on organisms; notions of radiological protection.
<b>Methods of study in biophysics:</b> sedimentation, methods for determining the molecular weight by centrifugation and ultracentrifugation, electrophoresis, X-ray analysis, ESR, MRI, fractal analysis.

<b>Practical works</b>
Experimental data processing
Determination of surface tension of biological fluids by stalagmometric method
Determination of the relative viscosity coefficient of biological fluids with an Ostwald viscometer
Determination of biological fluids conductivity with a Kohlrausch bridge
Determination of protein concentration by refractometric measurements
The study of optical lens
Determination of the refractive index at solids with an optical microscope

Determination of cells microscopic dimensions
Determination of the concentration of an optically active solution by polarimetric measurements
Determination of thin fibers thickness by diffraction
Experimental verification of the Stefan-Boltzmann law
Study of the chlorophyll absorption spectrum
Fractal analysis
Discussions

### **Bibliography**

1. Oancea S., *Biofizica*, ed. PIM, Iasi, 2008.
  2. Popescu A., *Fundamentele biofizicii moderne*, vol I, ed. All Bucuresti, 1994.
  3. Dragomirescu E., *Biofizica*, Editura Didactica si Pedagogica, Bucuresti, 1993.
  4. Davidovits P., *Physics in Biology and Medicine*, Third Edition, Academic Press, Elsevier, 2008.
  5. Duncan G., *Physics in the Life Sciences*, Blackwell Scientific Publications, The Alden Press, Oxford, 1990.
  6. Sybesma C., *Biophysics*, Kluwer Academic Publishers, Dordrecht, Boston, London, 1989.
- Oancea S., *Lucrări practice de fizică și biofizică*, ed. PIM, Iași, 2009.

### **Evaluation**

<b>Evaluation form</b>	<b>Evaluation Methods</b>	<b>Percentage of the final grade</b>
Course	Exam	70%
	presence	10%
Practical works	Tests + course and practical	20%

### **Contact**

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