

## Biophysics and Agrometeorology (I<sup>st</sup> Year of study, I<sup>st</sup> Semester)

Credit value (ECTS) 4

### Course category

Base domain (Imposed)

### Course holder:

Lecturer Dr. Ilie Bodale

### Discipline objectives (course and practical works)

The goal of the course is that students to understand the mechanism of evolution of biological structures and to acquire knowledge of biophysics and agrometeorology topics as support for future study specialized disciplines.

The course has two directions of study. First part is based on study of physics principles and processes from biophysics of biological structures or soil and influence of physical factors on plants growth and development. The second part is focused on study of atmospheric characteristics, methods of forecasting and influence of meteorological factors on plants growth and development.

The aim of practical laboratories are to improve student's practical skills in order to use apparatus and equipment used in the laboratory, to determine the biological properties of materials, to process independent experimental data, to analyze and compare experimental and theoretical results.

### Contents (syllabus)

Course (chapters/subchapters)
<b>Biophysics</b>
<b>Introduction</b> Objectives and methods of computational biophysics. Biophysics role in the natural sciences.
<b>Molecular Biophysics</b> Contact surface phenomena: surface tension, capillarity. Transport phenomena: diffusion, osmosis, viscosity.
<b>Concepts of biological thermodynamics</b> Parameters and thermodynamic systems. Thermodynamic principles. Applications in Biology: The compensation principle of entropy.
<b>Cellular Biophysics</b> The cellular structure. Elements of biophysics of membranes. Passive membrane transport (diffusion, osmosis) and active (facilitated diffusion, ion pumps). Selective transmission (ion channels).
<b>Physical factors influence the development and growth of plants</b> Vibration and noise. Non-ionizing radiation. Classification, characteristics, radiation sources and applications. Measuring the effects of action of non-ionizing radiation. Ionizing radiation. Classification, characteristics, radiation sources and applications. Measuring the effects of action of ionizing radiation.

<b>Agrometeorology</b>
<p><b>Earth's atmosphere and radiation</b>  Earth's atmosphere (troposphere). Vertical thermal structure of the atmosphere.  Chemical composition.</p>
<p><b>Solar, terrestrial and atmospheric radiations</b>  The spectrum of the solar radiation. Scattering, absorption and transmission of solar radiation.</p>
<p><b>Soil and air temperature</b>  Diurnal and annual temperature variation in soil and air.</p>
<p><b>Water vapor in the atmosphere</b>  The air humidity. The fog and clouds. International Classification of clouds. Nebulosity.  Condensation of water vapor in the atmosphere and terrestrial surface (Rainfall).  Water cycle.</p>
<p><b>Pressure and atmospheric dynamics</b>  Atmospheric pressure. Baric systems. Winds and currents of air.  Thermal fronts. The dynamics of air masses.</p>
<p><b>Climatology</b>  Climate. Climatic factors. Koppen classification of climates.  Global climate. The climate in Europe and Romania.  Characterization of local climates for agriculture.</p>
<p><b>The influence of climatic factors on growth and development of plants</b>  Introduction: plant growth and development. Phenology.  Temperature: termoperiodism, vernalization, action on plants.  Light: photoperiodicity, efficiency of photosynthesis, action on plants.  Water: critical period, the coefficient of sweat, quality of agricultural production.  Wind: mechanical and thermal actions, shelterbelts.  Other influences on crops. The combined effect of two or more factors.</p>
<p><b>Climate hazard. Damaging weather events agriculture</b>  The frosts: effects on cells, plants resistance at cold, damage, measures to combat the negative effects.  The hail: mekansim training effects on plants, damage, measures to combat the negative effects.  Water, heat, dry (drought) and wind excess: causes, damage, measures to combat the negative effects.</p>

<b>Practical works</b>
<p><b>The presentation of laboratory</b>  Work safety rules. Apparatus and equipment for measuring. International system of units.  Experimental data processing. Calculation errors.</p>
<p><b>Surface tension of biological fluids</b>  Measuring surface tension coefficient of fluids.  To study the effect of surface-active substances on the coefficient of surface tension of the solvent</p>
<p><b>The relative viscosity biological fluids</b>  Measuring coefficient of relative viscosity of biological fluids.</p>
<p><b>Meteorological data processing</b>  Graphical method used for determination of air thermal variations.</p>
<p><b>Air specific humidity</b>  Measuring specific humidity of atmospheric air using Assman Psychrometer.</p>

**Direct, diffuse and reflected solar radiation**

Measuring solar, terrestrial and atmospheric radiation using Pyranometer.  
Determining the actual duration of insolation and cloudiness appreciation.

**Final colloquium of knowledge evaluation****Bibliography**

1. S. Oancea, „Biofizică”, PIM Publisher, Iași, 2005
2. L. Tudor, „Introducere în Biofizică moleculară”, Univ. „Al. I. Cuza” Publisher, Iași, 2001
3. A. Popescu, „Fundamentele biofizicii medicale”, All Publisher, București, 1994
4. G. Roland, „Biophysics”, Springer-Verlag GmbH Publisher, Berlin – Germany, 2012
5. N. Cojocaru și S. Oancea, „Biofizică și Agrometeorologie”, USAMV, 2014, Iași
6. L. Enache, „Agrometeorologie”, USAMV Publisher, București, 2009
7. H. Criveanu, „Biofizică agricolă”, Digital Data Publisher, 2006
8. C. Dissescu et al, „Fizică și Climatologie Agricolă”, Didactică și pedagogică Publisher, București, 1971
9. S. Oancea, „Lurări practice de fizică și biofizică”, PIM Publisher, Iași, 2009
10. S. Oancea, I. Motrescu, „Observarea și înregistrarea principalelor elemente meteorologice”, Performantica Publisher, Iasi, 2007

**Evaluation**

Evaluation form	Evaluation Methods	Percentage of the final grade
Colloquy	Written examination	60%
Appreciation of the activity during the semester	Oral assessment during the semester, verification tests and final laboratory colloquium.	40%

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