...BIOPHYSICS AND AGROMETEOROLOGY....

(Landscape engineering, 1st Year of study, 1st Semester)

Credits (ECTS): 4

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

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

Objectives of the discipline:

The discipline objectives consist in the study of biophysical and agrometeorological to understand the living organisms and atmospheric behavior. Necessary knowledge for the advanced study of specialized subjects.

Contents (syllabus)

Course (chapters/subchapters)
1. Introduction. The aims and methods of biophysics
2. Notions of fluid biophysics 2.1. Molecular phenomena at the surface of liquids (surface layer, surface tension). Applications in the living and technique. 2.2. Molecular phenomena at the liquid-solid-gas contact (capillarity, adsorption and absorption). Applications in the living and technique. 2.3. Molecular transport phenomena (viscosity, simple diffusion, osmosis). Applications in the living and technique.
3. Notions of biological thermodynamics 3.1. Biological and meteorological thermodynamic systems. State parameters and functions. 3.2. The postulates and principles of thermodynamics that govern the living world. 3.3. Thermodynamic characterization of biological systems. Applications in horticulture.
4. Disturbance and radiation 4.1. Sound and ultrasound. Effects of sounds and ultrasound on biological environments. 4.2. Non-ionizing radiation. Effects of IR, MU and UV radiation on living organisms. 4.3. Natural and artificial radioactivity. Ionizing radiation. Effects of ionizing radiation on organisms.
5. Fundamentals of meteorology 5.1. Meteorology and climatology. 5.2. Weather station. Meteorological measurements and observations.
6. Atmosphere and solar radiation 6.1. Earth's atmosphere. The thermal and chemical structure of the atmosphere. 6.2. Direct, diffuse, absorbed and reflected solar radiation. The radiative balance. 6.3. Albedo of surfaces. 6.4 Insolation. Diurnal and annual variation of insolation around the globe.

7. Soil and air temperature

7.1 Soil temperature. The mechanism of soil heating.

7.2 Factors influencing soil warming.

7.3 Diurnal and annual variation of soil temperature at different depths.

7.4 Air temperature. Air heating mechanisms.

7.5 Absorption and transmission of radiation by different gases. The greenhouse effect. Factors influencing air heating.

7.6. Diurnal and annual variation of air temperature in different regions.

8. Dynamics of air masses

8.1. Air masses. Classification of air masses.

8.2. Atmospheric pressure. Baric formations. Vertical pressure variation.

8.2. Atmospheric fronts.

8.3. The winds. Formation mechanisms. Classification of winds. The winds in Europe and Romania.

9. Water vapor and precipitation

9.1. Air humidity. Specific, absolute and relative humidity of the air. Dew point.

9.2. Meteorological phenomena generated by the condensation of water vapor near the ground.

9.3. Condensation of water vapor in the atmosphere.

The clouds. Classification of clouds.

Atmospheric precipitation. Classification of precipitation.

9.4. Evaporation and evapotranspiration.

10. The influence of climatic factors on the growth and development of plants

10.1. The influence of temperature on plants.

10.2. The influence of light radiation on plants.

10.3. The influence of water on plants.

10.4. The influence of wind on plants.

11. Climatic accidents - Extreme weather phenomena

11.1. The frost. The formation mechanism of frosts. Effects of frosts on plants. Passive and active measures to reduce the effects of frost.

11.2. Hail. Hail formation mechanism. Effects of hail on plants. Passive and active measures to reduce the effects of hail.

11.3. Drought. Effects of drought on plants. Passive and active drought mitigation measures.

11.3. Excess water. Effects of excess water on plants. Passive and active measures to reduce the effects of excess water.

11.5. Blizzard, storms and tornadoes. Their effects on crops.

12. Global climate. The effect of climate change on agriculture

12.1. Genesis and characteristics of climates.

12.2. Climate classification according to Köppen.

12.3. Climate in Romania.

12.4. Agroclimatology.

12.5. Climate change and its influence on plants

Practical activity
1. Introduction 1.1 Presentation of the objectives and working methodology in the laboratory 1.2 Labor protection measures in the laboratory. 1.3 Processing of measured data. 1.4. Notions of error calculation.
2. Determination of the properties of biological liquids 2.1 The dynamic viscosity coefficient of liquids using the Oswald viscometer and the Stokes's method; 2.2 The surface tension coefficient of liquids using the Traube stalagmometer 2.3 Electrical resistance and conductivity of a biological liquid using the Kohlrausch bridge 2.4 Sugar concentration in fruit with Abbe refractometer and Laurent polarimeter
3. Measurement of meteorological elements using automatic weather station, recorders and specific instruments 3.1 Atmospheric pressure. Sea level pressure reduction. 3.2 Relative air humidity (electric psychrometer, psychrometric table and hygrometer). 3.3 Direct, diffused and reflected solar radiation using the pyranometer. 3.4 The amount of precipitation with the pluviometer. 3.5 Wind direction and speed with vane and anemometer.
4. Processing of agrometeorological data to characterize the weather 4.1 Daily, decadal, monthly, annual and multiannual minimum, maximum and maximum temperature 4.2 Amount of monthly, seasonal, annual and multiannual precipitation in different sub-climatic regions.
5. Representation of meteorological elements on weather charts and maps 5.1 Minimum, average and maximum temperatures for the decades of a year. 5.2 Annual precipitation 5.3 Representation of meteorological elements on maps using isolines, symbols, color codes and numerical values
6. Atmospheric fronts 6.1 Identification of different types of fronts. 6.2 Identification of fronts by cloud succession 6.3 Weather characterization methods based on meteorological observations.

Bibliography

1. Bodale I., 2022 – „Biofizică și Agrometeorologie", 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. Bodale I., 2021 – „Măsurarea și prelucrarea datelor meteorologice", Iași: Editura „Ion Ionescu de la Brad".
4. Bodale I., 2020 – „Referate pentru laboratorul de Biofizică", USV Iași.
5. Liviu Mihai Irimia (coordonator), autori: D. Cazacu, V. Vlahidis, C. Sîrbu, I. Bodale, et al, 2021 – „Manual de practică. Specializarea Horticultură", vol. 1, Iași: Editura Ion Ionescu de la Brad.

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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