Biophysics (1st Year of study, 2nd Semester)

Credit value (ECTS) 5

Course category
Fundamental (Imposed)

Course holder:
Assist. Prof. Dr. 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)

Course (chapters/subchapters)
Biophysics: subject, methods of study and historical evolution; research domains.
Biological fluids: fluids, generalities, main characteristics of biological liquids; water and its properties.
Molecular phenomena in liquids: surface tension, capillarity, viscous fluids, Newton's law, liquid flow through tubes, laminar and turbulent flow, notions of hemodynamics (blood circulation).
Diffusion, laws of diffusion, osmosis and osmotic pressure, the osmotic pressure of biological fluids.
Biological membranes: membrane biophysics, cell membrane functions, types of transport through the cell membrane, passive transport, active transport.
Thermodynamics of biological processes: 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.
Analyzers. Visual analyzer: the eye as an optical system; biophysics of vision. Auditory analyzer: the inner ear, biophysics of hearing, ultrasounds and their use.
Notions of radiation biophysics: 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.
Methods of study in biophysics: sedimentation, methods for determining the molecular weight by centrifugation and ultracentrifugation, electrophoresis, X-ray analysis, ESR, MRI, fractal analysis.

Practical works
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
Study of the blood absorption spectrum
Determination of thin wires thickness by diffraction
Detection and measurement of nuclear radiation
Experimental verification of the Stefan-Boltzmann law
Fractal analysis

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.
7. Oancea S., *Lucrări practice de fizică și biofizică*, ed. PIM, Iași, 2009.

Evaluation

Evaluation form	Evaluation Methods	Percentage of the final grade
Exam	Written examination	70%
Appreciation of the activity during the semester	Oral assessment during the semester	30%

Contact

Assist. Prof. Dr. Ana CAZACU
Faculty of Horticulture - USAMV Iasi
3 Mihail Sadoveanu Alley, Iasi, 700490, Romania
Telephone: 0040 232 407412
E-mail: anacazacu@uaiasi.ro