**ACADEMIC DISCIPLINE OVERVIEW**

1. **Program data**

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| **1.1.** | **GRIGORE T. POPA UNIVERSITY OF MEDICINE AND PHARMACY IASI** |
| **1.2.**  | **FACULTY OF MEDICAL BIOENGINEERING**  |
| **1.3.** | **PROGRAMME:** Physio-kinetotherapy and rehabilitation |
| **1.4.**  | **STUDY FIELD:** Health |
| **1.5.** | **STUDY CYCLE**: UNDERGRADUATE |
| **1.6.** | **STUDY PROGRAMME:** INENGLISH |
| 1. **Subject data**
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| **2.1.** | **Subject: Biophysics**  |
| **2.2.** | **Module leader: Lecturer Dr. Andrei Vasile Nastuta** |
| **2.3.** | **Seminar leader: Lecturer Dr. Andrei Vasile Nastuta** |
| **2.4. Year of study** | **I** | **2.5. Semester in which is taught** | **I** | **2.6. Evaluation type** | Examwritten | **2.7. Subject status** | Mandatory |

1. **Estimated total time (hours/semester of didactic activity)**

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| **3.1.Number of hours / week** | 2 | **3.2. Courses number of hours / week** | 1 | **3.3.Seminar / l practical classes** | 1 |
| **3.4. Total number of learning hours** | 28 | **3.5. Courses** | 14 | **3.6. Seminar / practical classes** | 14 |
| **3.7. Distribution of the available time** | Hours |
| **Study based on the manual, lecture support, bibliography and hand notes** | 10 |
| **Supplementary documentation in the library, using specialised platforms via internet and by field work** | 6 |
| **Preparation for seminars / practical classes, study themes, reviews, portofolio, and essays** | 6 |
| **Tutorship** | 2 |
| **Examinations** | 4 |
| **Other activities** | - |
| **3.8. Total hours of individual study** | 22 |
| **3.9. Total hours per semester** | 50 |
| **3.10. Number of credits** | 2 |

1. **Preconditions (where applicable)**

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| **4.1.** of curriculum | - |
| **4.2.** of competences | - |

1. **Conditions (where applicable)**

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| **5.1.** for lectures | Logistic video support |
| **5.2.** for seminars / practical classes | Students will wear protective clothing (white coats) |

1. **Specific competences acquired**

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| Professional competences (expressed as knowledge and abilities) |  Using the base knowledge for explanation and interpretation of electrotherapy procedures. Description of muscular and articular techniques, functional assessment scores and appreciation of the life quality of patients with disabilities. Using base knowledge for choosing means and methods of functional assessment in different pathological situations |
| Transverse competences (of role, of professional development, personal) | Identify objectives to be achieved, the available resources, the conditions for completion of their work flow, working time, deadlines and related risks |

1. **Objectives of the study discipline (according to the grid of specific competences acquired)**

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| **7.1.** General objective | The accumulation of knowledge about physical phenomena underlying the organization and functioning of the living world; |
| **7.2.** Specific objectives | Developing the working capacity of students with laboratory equipment. Acquiring specific experimental techniques and correlations with outcomes from related fields (e.g. biology, biochemistry). |

1. **Contents**

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| **8.1. Lecture** | **Teaching methods** | **Observations** |
| 1.Introduction to atomic and molecular physics1.1. Atomic models1.2. Physico-chemical organization of living mater | Statements, questioning, observation, dialogue, debate, explanation, demonstration | 2h |
| 2. Supramolecular assembly elements2.1. Polarizability of molecules2.2. Intermolecular forces2.3. Supramolecular assembly of living mater2.4. Supramolecular architecture of living mater | Statements, questioning, observation, dialogue, debate, explanation, demonstration | 2h |
| 3. Experimental techniques used for the analysis of biophysical systems3.1. Centrifugation, mass spectrometry, electrophoresis3.2. UV-Vis spectroscopy, FT-IR spectroscopy and fluorescence | Statements, questioning, observation, dialogue, debate, explanation, demonstration | 2h |
| 4. Elements of physics of transport phenomena in biological environments4.1. Particle diffusion4.2. Osmosis | Statements, questioning, observation, dialogue, debate, explanation, demonstration | 2h |
| 5. Architecture and properties of cell membranes5.1. The lipid bilayer model5.2. Organization of proteins and carbohydrates5.3. Electrical properties (resistance and capacitance) of the lipid bilayers | Statements, questioning, observation, dialogue, debate, explanation, demonstration | 2h |
| 6. Passive and active transport phenomena in biological membranes6.1. Membrane transport proteins6.2. Potential equilibrium6.3. Ionic channels, characteristic potential | Statements, questioning, observation, dialogue, debate, explanation, demonstration | 2h |
| 7. Neurophysics7.1. Action potential and Hodgkin-Huxley model7.2. Models for the electrical and chemical synapses | Statements, questioning, observation, dialogue, debate, explanation, demonstration | 2h |
| **Bibliography****mandatory**1. C. Stefanescu, V. Rusu, Biophysics and medical physics: an introduction. Ed. Tehnopress, Iasi, 2008.
2. M.B. Jackson, Molecular and Cellular Biophysics, Cambridge University Press, 2006.
3. D. Goldfarb, Biophysics demystified, McGraw-Hill, New York, 2011.
4. I. P. Herman, Physics of the human body, Springer Berlin, 2016.
5. B. Martinac Series Editor, Springer Series in Biophysics, Springer Berlin Heidelberg New York, 1987-2015.
6. J. A. Tuszynski, Molecular and Cellular Biophysics, CRC Press, 2016.
7. V. Raicu, A. Popescu, Integrated Molecular and Cellular Biophysics, Springer, 2008.
8. T. A. Waigh, Applied Biophysics A Molecular Approach for Physical Scientists, John Wiley & Sons, 2007.
9. J. Thomas, Handbook of Modern Biophysics, Fundamental Concepts in Biophysics, Vol 1, Humana Press, Springer, 2009.
10. J. Thomas, Handbook of Modern Biophysics, Biomembrane Frontiers Nanostructures, Models, and the Design of Life, Vol 2, Humana Press, Springer, 2009.
11. J. Thomas, Handbook of Modern Biophysics, Biomedical Applications of Biophysics, Vol 3, Humana Press, Springer, 2010.
12. B. Nolting, Methods in Modern Biophysics, 3ed edition, Springer-Verlag Berlin Heidelberg 2009.
13. J. J. Correia, H. W. Detrich, Methods in Cell Biology, Vol 89, Biophysical Tools for Biologists, In Vivo Techniques, Vol. 2, Academic Press, Elsevier, 2008.
14. A. W. Wood, Physiology, Biophysics, and Biomedical Engineering, CRC Press, Taylor & Francis, 2012.
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| **8.2. Seminar / practical classes** | **Teaching methods** | **Observations** |
| 1. Safety. Presentation of specific elements of biophysics laboratories 1.1. Safety regulations1.2. Quantities and units of measure1.3. Analysis of experimental data1.4. Sources of errors1.5. Calculation of errors1.6. Carrying out a laboratory report | Practical work, experimental demonstrations. | 2h |
| 2. Emission spectra of atoms and molecules. Determination of Planck constant. | Preparing the experimental arrangement and work strategy. Experimental data processing. Interpretation and extrapolation. | 2h |
| 3. Highlighting the intermolecular forces by colorimetric methods. Determination of surface tension3.1. Classification of intermolecular forces3.2. Demonstration by means of a colorimetric method, of hydrogen bonds formed between the water molecules and alcohol molecules3.3. Determination of surface tension for different liquid via droplet method | Preparing the experimental arrangement and work strategy. Experimental data processing. Interpretation and extrapolation. | 2h |
| 4. The principles of UV-Vis absorption spectroscopy 4.1. Defining the phenomenon of light absorption in liquids4.2. Visualization of the phenomenon of light absorption for different substances4.3. Determination of coefficient of extinction | Preparing the experimental arrangement and work strategy. Experimental data processing. Interpretation and extrapolation. | 2h |
| 5. Determination of the permeability coefficient of an artificial membrane5.1. Definition of the diffusion phenomena5.2. Study of diffusion phenomenon through artificial membranes5.3. Calculation of permeability coefficient for an artificial membrane | Preparing the experimental arrangement and work strategy. Experimental data processing. Interpretation and extrapolation. | 2h |
| 6. Lipid bilayers. Study of modern experimental techniques in biophysics6.1. Obtaining lipid bilayers6.2. Determination of the electrical properties of the lipid bilayers6.3. Voltage-clamp technique for measuring transmembrane electric currents6.4. Patch-clamp technique for studying ion channels | Preparing the experimental arrangement and work strategy. Experimental data processing. Interpretation and extrapolation. | 2h |
| 7. Nerve excitability and propagation of action potentials. Evaluation activity.7.1. Testing practical skills acquired by students7.2. Evaluation of theoretical knowledge acquired during the biophysics laboratory | Preparing the experimental arrangement and work strategy. Experimental data processing. Interpretation and extrapolation. Evaluation. | 2h |
| **Bibliography****mandatory**1. C. Stefanescu, V. Rusu, Biophysics and medical physics: an introduction. Ed. Tehnopress, Iasi, 2008.
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8. T. A. Waigh, Applied Biophysics A Molecular Approach for Physical Scientists, John Wiley & Sons, 2007.
9. J. Thomas, Handbook of Modern Biophysics, Fundamental Concepts in Biophysics, Vol 1, Humana Press, Springer, 2009.
10. J. Thomas, Handbook of Modern Biophysics, Biomembrane Frontiers Nanostructures, Models, and the Design of Life, Vol 2, Humana Press, Springer, 2009.
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14. A. W. Wood, Physiology, Biophysics, and Biomedical Engineering, CRC Press, Taylor & Francis, 2012.
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1. **Correlation of the discipline contents with the expectations of the epistemic community, professional associations, and representative employers from the afferent program field**

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| Knowledge and abilities are established as didactic objectives and specified as such in the analytic programs that are revised yearly. After their analysis by the study discipline staff, these are discussed and approved in the Curricular Committee, towards curricular harmonization among the various study disciplines. Along this entire process systematic evaluation is performed, directly if possible, regarding the correspondence of the contents to the expectations of the academic community and of the representatives of the social community, professional associations, and employers. |

1. **Evaluation**

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| **Type of activity** | **Type of activity** | **Evaluation methods** | **Contribution to the final grade** |
| **Lecture** | Acquiring theoretical aspects and concepts presented in the course | Written exam | 50% |
| **Seminar/practical classes** | Practical works topics | Colloquium for practical work | 40% |
| Activity during the semester |  | 10% |
| **Minimal performance standard:****- Knowing the forces classes and general physical phenomena in cell biology** |

**Date of completion: Signature of head of discipline**

25.09.2019 Lecturer Dr. Andrei Vasile Năstuţă

**Department approval date**

30.09.2019

**Signature of department director**

 Lecturer Daniela-Viorelia Matei, Ph-D