**COURSE OUTLINE**

1. **GENERAL**

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| **SCHOOL** | School of Health Sciences | | | | |
| **ACADEMIC UNIT** | Faculty of Medicine | | | | |
| **LEVEL OF STUDIES** | Undergraduate | | | | |
| **COURSE CODE** | ΙΑΕ509 | **SEMESTER** | | 5 | |
| **COURSE TITLE** | SELECTED TOPICS IN BIOPHYSICS | | | | |
| **INDEPENDENT TEACHING ACTIVITIES** *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits* | | | **WEEKLY TEACHING HOURS** | | **CREDITS** |
| Written Assignment | | | 2 | | 2 |
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| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).* | | |  | |  |
| **COURSE TYPE**  *general background,  special background, specialised general knowledge, skills development* | Special background, specialised general knowledge, skills development | | | | |
| **PREREQUISITE COURSES:** | - | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | Yes (English) | | | | |
| **COURSE WEBSITE (URL)** | [Microsoft Teams](https://teams.microsoft.com/l/team/19%3A31ba5b58796d42cabd384cfed3b40e6b%40thread.tacv2/conversations?groupId=7fdbb70d-35ad-4d64-99d3-cdefd41599e6&tenantId=08bea52a-5ad3-4627-9549-5ff3a65676be)  [What is Biophysics](https://uoioannina.sharepoint.com/:b:/s/msteams_80a03f/EYX8PIIOazBDgmwy38XrqUQBo657EGrylp8JV-WyL8_FEw?e=csPeh7)  [ecourse.uoi.gr](https://ecourse.uoi.gr/mod/forum/view.php?id=64585) | | | | |

1. **LEARNING OUTCOMES**

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| **Learning outcomes** | |
| *The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.*  *Consult Appendix A*   * *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area* * *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B* * *Guidelines for writing Learning Outcomes* | |
| **The curriculum is divided into four main modules to cover a wide range of topics relevant to the diverse field of biophysics:**  **Module 1: Medical Imaging and Therapy**  **This module focuses on the physical principles and technologies utilized in medical imaging and therapeutic approaches. It explores the principles of methods such as magnetic resonance imaging, (cryo)-electron microscopy, microscopy, and spectroscopy, which are emerging tools in modern diagnostics and treatment.**  **Module 2: Biophysics of Cellular and Molecular Processes**  **This module investigates the physical mechanisms underlying cellular and molecular functions. Students will study the structure and properties of membranes, the dynamics and roles of molecular machines, the significance of water in biological systems, and biological thermodynamics. They will gain an understanding of how physical forces influence fundamental biological processes.**  **Module 3: Applications of Biophysics in Diseases and Therapies**  **This module examines how biophysical principles are applied to understanding diseases and developing therapies. Emphasis is placed on topics such as protein aggregation in neurodegenerative diseases, cancer metastasis mechanisms, biophysical techniques for drug design, and the use of nanoparticles for targeted drug delivery. Students will explore how biophysical approaches accelerate translational research.**  **Module 4: Advanced Techniques and Methodologies**  **This module presents the latest advancements in biophysical research, including computational approaches, molecular dynamics simulations, quantum biology, and artificial intelligence. Students will develop skills in applying these methodologies to analyze biological data and solve complex problems.**  **The course is aligned with Level 6, as it is designed for undergraduate students.**  **Upon completion, students will acquire:**   * **Specialized knowledge in biophysics and medical physics.** * **Skills to apply knowledge for understanding technologies and methods related to medical diagnosis and treatment.** * **Autonomous capabilities to explore contemporary health research topics.** | |
| **General Competences** | |
| *Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?* | |
| *Search for, analysis and synthesis of data and information, with the use of the necessary technology*  *Adapting to new situations*  *Decision-making*  *Working independently*  *Team work*  *Working in an international environment*  *Working in an interdisciplinary environment*  *Production of new research ideas* | *Project planning and management*  *Respect for difference and multiculturalism*  *Respect for the natural environment*  *Showing social, professional and ethical responsibility and sensitivity to gender issues*  *Criticism and self-criticism*  *Production of free, creative and inductive thinking*  *……*  *Others…*  *…….* |
| **The course "Selected Topics in Biophysics" aims to develop both fundamental and specialized skills required for studying the contemporary aspects of Biophysics and Medical Physics. Through the preparation of written assignments and the analysis of scientific data, students enhance their ability to research and synthesize information. Simultaneously, autonomy in work is fostered by engaging with specialized topics in basic sciences.**  **The interdisciplinary nature of the course, which integrates physics, biology, and cutting-edge technologies, prepares students to operate effectively in multidisciplinary environments. Furthermore, critical thinking is cultivated, as students are encouraged to study and document contemporary scientific advancements. Finally, the course promotes professional responsibility, emphasizing the ethical use of scientific methods.** | |

1. **SYLLABUS**

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| **The course "Selected Topics in Biophysics" focuses on the study of the physical principles and methods underlying biological processes and their applications in biomedical research and clinical practice. The syllabus covers a wide range of topics, including molecular, cellular, and systemic approaches in biophysics. It examines the physical properties of biomolecules (such as proteins, DNA, and lipids), membrane biophysics, molecular machines involved in cellular transport and function, as well as the application of advanced techniques, such as spectroscopy, specialized microscopy, and simulation methods.**  **The course also includes the analysis and application of cutting-edge technologies in areas such as medical imaging (e.g., MRI, OCT, PET/CT), microscopy, spectroscopy, understanding disease-related mechanisms (e.g., cancer and neurodegenerative disorders), and employing biophysical techniques for drug design and targeted delivery. Emphasis is placed on an interdisciplinary approach that bridges physics with biology and medicine, while the content is adapted to address contemporary research challenges, such as the use of artificial intelligence and computational tools for the analysis of biological systems.** |

1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **DELIVERY** *Face-to-face, Distance learning, etc.* | **Face-to-face, Distance learning, Written Assignment** |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | **The course uses information technology, integrating tools that create a comprehensive and unified teaching environment. Indicatively, applications such as MS Teams, MS Forms, MS SharePoint, MS Power Automate, and Turnitin are utilized.** |
| **TEACHING METHODS**  *The manner and methods of teaching are described in detail.*  *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.*  *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS* | |  |  | | --- | --- | | ***Activity*** | ***Workload of each students group*** | | Lectures | 4 | | Study & Analysis of Literature | 16 | | Written Assignment | 30 | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |
| **STUDENT PERFORMANCE EVALUATION**  *Description of the evaluation procedure*  *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*  *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | **Assessment in the course "Selected Topics in Biophysics" is performed in the language of instruction, Greek, with the analysis of international literature predominantly in English. The assessment process is based on the preparation of a written assignment, through which students develop skills in analysis, synthesis, and application of knowledge. They are required to engage with specialized biophysics topics, using scientific literature to present their findings with clarity and evidence-based reasoning.**  **The assignment is evaluated based on predefined criteria, including structure and coherence, the comprehensiveness of analysis, appropriate use of references, and originality of approach. The objective of the assessment is not merely to measure academic performance but also to enhance skills such as autonomy, critical thinking, scientific documentation, and effective communication.** |

1. **ATTACHED BIBLIOGRAPHY**

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| **International Scientific Literature Databases**  **Scientific Articles in Collaboration with the Course Instructor**  **Activities of the Biophysical Society** |