# COURSE OUTLINE

## (1) GENERAL

| | | | |
|---|---|---|---|
| **SCHOOL** | Engineering | | |
| **DEPARTMENT** | Electrical and Computer Engineering | | |
| **LEVEL OF STUDY** | Undergraduate | | |
| **COURSE UNIT CODE** | 9.014 | **SEMESTER** | 9th |
| **COURSE TITLE** | Advanced Topics in Biomedical Engineering Topics | | |

| **COURSEWORK BREAKDOWN** | **TEACHING WEEKLY HOURS** | **ECTS Credits** |
|---|---|---|
| Theory (Lectures) | 4 | 3 |
| Tutorial/Exercises | 1 | 1 |
| **TOTAL** | **5** | **4** |

| | |
|---|---|
| **COURSE UNIT TYPE** | Special background |
| **PREREQUISITES** | 7.013 – Biomedical Technology<br>8.016 – Biomedical Signals and Applications |
| **LANGUAGE OF INSTRUCTION/EXAMS** | Greek |
| **COURSE DELIVERED TO ERASMUS STUDENTS** | YES (in English) |
| **WEB PAGE (URL)** | https://eclass.hmu.gr/courses/ECE134/ |

## (2) LEARNING OUTCOMES

**Learning Outcomes**

This course, using appropriate learning methodologies (Project-based learning) will focus on the application of basic principles of science and engineering to formulate, study and solve problems in the interface of engineering, medicine, and biology. The goal is twofold: on the one hand the quantitative study of important functions of living organisms and the understanding of the underlying molecular, cellular, or physiological mechanisms and on the other hand the deepening into the principles of engineering science that govern the field of biomedical engineering and are necessary for designing and studying the function of biomedical systems.

Upon completion of this course, the student will have acquired the necessary knowledge and skills to:

- Gain a deeper knowledge in the sub-area of biomedical engineering chosen for study.
- Conduct an independent bibliographic review and critical analysis of the current state-of-the-art knowledge.
- Define a specific research question, design, and conduct a preliminary study, in the form of a literature study or a limited research project.
- Select and implement specific solutions for future problems/questions
- Analyze independently the results of the study and evaluate the capabilities of the suggested project.

In conclusion, the student will acquire the knowledge and skills to analyze a sub-area of Biomedical Engineering with a specific biological or biotechnological focus, i.e., dealing with the chemistry, structure or function of cells, tissues or entire organisms.

**General Skills**

- Search, analysis, and synthesis of data and information, using the necessary technologies
- Design, implementation of small research and development projects
- Decision making
- Autonomous work
- Teamwork
- Production of free, creative and inductive thinking

## (3) SYLLABUS

**Theoretical part of the course**

The theoretical part of the course focuses on a thorough review of the challenges for Engineers in selected areas of Biomedical Engineering, and on highlighting how it promotes medical practice and understanding, with the help of examples from the areas of bio-electricity, biomedical signals, bio-imaging, and biomechanics as well as molecular, cellular and tissue engineering.

It focuses on the application of basic principles of science and engineering to formulate, study, and solve problems at the interface of engineering, medicine, and biology. The goal is twofold: on the one hand the quantitative study of important functions of living organisms and the understanding of the underlying molecular, cellular, physiological mechanisms and on the other hand the deepening of the principles of engineering science that govern the field of biomedical engineering and are necessary for designing and studying the biomedical system function.

**Laboratory part of the course**

The laboratory part of the course is organized into small or medium complexity projects, following corresponding learning theories (Project-Based Learning). Each project consists of 2-4 students who perform their tasks with the help of a supervisor.

Each project includes the following:

- Literature review in the context of the project. Relevant scientific literature is searched and its content is analyzed and evaluated. Thusly, knowledge of the field and the alternative methods that are suitable for use in the project are gathered and acquired.
- Definition, in collaboration with the supervisor-professor of the exact object of the project, the working methods are agreed and the intermediated and final objectives are defined.
- The students of each group, under the supervision and guidance of the supervisor, implement the project, and organize the evaluation of the results.
- An extensive and comprehensive report is prepared to contain the literature review, a description of the implemented solution, details of how it was implemented, and the results produced. The report can take the form of a scientific paper.
- A presentation of the project, its objectives, and the result produced is prepared and presented.

## (4) TEACHING METHODS - ASSESSMENT

| | |
|---|---|
| **MODE OF DELIVERY** | In-Class Face-to-Face |
| **USE OF INFORMATION AND COMMUNICATION TECHNOLOGY** | Use of information and communication technology in teaching<br>Use of information and communication technology in laboratory teaching<br>Use of information and communication technology for communicating with the students using the electronic platform eClass |
| **TEACHING ORGANIZATION** | |

| Method description / Activity | Semester Workload |
|---|---|
| Lectures | 13 |
| Coaching lectures | 13 |
| Small individual practice tasks | 13 |
| Group project | 52 |
| Independent study | 29 |
| | |
| | |
| **Total Contact Hours** | **120** |

| | |
|---|---|
| **ASSESSMENT METHODS** | The assessment is based on the total participation of each student in the group project (20%), on the evaluation of the written report that each student delivers (40%), and on the evaluation of the presentation that each student makes (40%).<br><br>The assessment criteria are clearly stated in the detailed description of the course located in the relevant course area in eClass. |

## (5) RECOMMENDED BIBLIOGRAPHY

***Suggested Bibliography:***

- *John Enderle, Joseph Bronzino, Introduction to Biomedical Engineering, ISBN-13: 978-0123749796*
- *Stefanos Zenios, Josh Makower, Paul Yock, Todd J. Brinton, Uday N. Kumar, Lyn Denend, Thomas M. Krummel, Biodesign: The Process of Innovating Medical Technologies 1st Edition, ISBN-13: 978-0521517423*
- *Joseph D. Bronzino, Donald R. Peterson, The Biomedical Engineering Handbook: Four Volume Set 4th Edition, ISBN-13: 978-1439825334*
- *Instructor Notes on selected topics of Biomedical Engineering*

***Related scientific journals:***

- *IEEE Transactions on Biomedical Engineering*
- *IEEE Biomedical and Health Informatics*
- *Nature Biomedical Engineering*
- *Annual Review of Biomedical Engineering*
- *Bioengineering (MPDI)*