COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	7.013	**SEMESTER**	7th
COURSE TITLE	Biomedical Technology		

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

COURSE UNIT TYPE	Special background
PREREQUISITES	none
LANGUAGE OF INSTRUCTION/EXAMS	Greek
COURSE DELIVERED TO ERASMUS STUDENTS	YES (in English)
WEB PAGE (URL)	https://eclass.hmu.gr/courses/ECE127/

(2) LEARNING OUTCOMES

Learning Outcomes

Biomedical technology (bioengineering) is the scientific field that applies the rationale and methods of the science of biology (and secondarily of physics, mathematics, chemistry and computer science) in combination with the methodologies of analysis and synthesis of the engineering science to solve problems related to biological systems.

The purpose of biomedical technology is to contribute to the understanding of the basic principles of function of the biological systems and to the development of efficient technologies, based on biology, to meet a wide range of social needs. These needs can be related to the diagnosis, prevention and treatment of diseases, the development of new materials, devices and procedures and even the treatment of wider environmental problems.

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

- Understand the basic principles of function of the biological systems
- Know the basic categories of biomedical technology and their special characteristics such as bio-electricity and biomechanics.
- Design the development of efficient biology-based technologies.
- Design and implement integrated systems using sensors and biosensors of various types.
- Design and implement wireless body area networks (WBANs) or body sensor networks (BSNs)

General Skills

- Search, analysis and synthesis of data and information, using the necessary technologies
- Design and project management
- Decision making
- Autonomous work
- Teamwork
- Production of free, creative and inductive thinking

(3) SYLLABUS

The course is structured as follows:

Theoretical part of the course

- Introduction to the field of Biomedical Technology and highlighting how it promotes medical practice and understanding, with the help of examples of bio-electricity, bio-transfer, bio-imaging, and biomechanics.
- Basic principles of biomedical electronics and measurements
- Introduction to the concept of signal and the properties of the signal
  - Definitions, sampling, and reconstruction. Signal storage on the computer (quantization)
  - The concepts of convergence and correlation
  - Discrete Fourier transform
- Biological signal recording devices (pressure, flow, bioelectric potential, temperature, displacement) and amplifiers.
- Examples of biomedical signals (ECG, EEG) and their analysis
- Data compression: Necessity, examples, lossless compression, lossy compression.
- Biomedical organology
  - Sensors and biosensors: temperature sensors, fiber optics, and fluorescence biosensors
  - Sensors and biosensors: chemical, electrochemical, oxygen sensors, optical, piezoelectric
  - Biosensor networks and medical monitoring
  - Wireless body area networks (WBANs) or body sensor networks (BSNs)
- Biomaterials and implantable devices
- Artificial organs

Laboratory part of the course

The laboratory part of the course through real cases of small-scale problems will focus on the deepening of the respective theoretical knowledge.

(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 Use of information and communication technology in laboratory teaching Use of information and communication technology for communicating with the students using the electronic platform eClass
TEACHING ORGANIZATION	

Method description / Activity	Semester Workload
Lectures	26
Coaching lectures	13
Small individual practice tasks	26
Group project	26
Independent study	29
Total Contact Hours	**120**

ASSESSMENT METHODS	**Theory**: Final written exam on the entire syllabus (100%). The exam includes theory questions (from 3 to 5) and practical exercises (from 1 to 2).

	Laboratory: The final grade results from the laboratory work (50%) and the elaboration of a greater complexity project (50%). 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:

- *Biomedical Technology and Devices, James E. Moore Jr, Duncan J. Maitland, 2nd Edition, CRC Press, 2013, ISBN 9781439859599*
- *Medical Devices and Human Engineering, 1st Edition, Joseph D. Bronzino, Donald R. Peterson, CRC Press, 2014, ISBN 9781439825259*
- *Principles of Tissue Engineering. Lanza R, Langer R, and Vacanti JP (Eds.), Elsevier Academic Press, 4th edition, 2014.*
- *Biomaterials Science: An Introduction to Materials in Medicine. 3nd Edition, Ratner, Hoffman, Schoen, and Lemons (Eds), Elsevier Academic Press, 2013. http://www.sciencedirect.com/science/book/9780123746269*
- *Trail guide to movement. Books of Discovery, Biel A., 1st edition, 2015.*
- *Wireless Body Area Network (WBAN) for Medical Applications, Jamil. Y. Khan, Mehmet R. Yuce, eBook*
- *Instructor Notes*

Related scientific journals:

- *IEEE Transactions on Biomedical Engineering*
- *IEEE Biomedical and Health Informatics*
- *Bioengineering (MPDI)*
- *Biosensors and Bioelectronics*
- *Current Opinion in Biotechnology*