COURSE CONTENT

(1) GENERAL INFO

SCHOOL	ENGINEERING			
DEPARTMENT	BIOMEDICAL ENGINEERING			
MSc PROGRAM	BIOMEDICAL ENGINEERING AND TECHNOLOGY			
STUDY LEVEL	POSTGRADUATE, MSc			
COURSE CODE	**BMET101**	**SEMESTER**	**A**	
COURSE TITLE	**The science of biomedical engineering**			
TEACHING			**HOURS**	**ECTS**
		LECTURES	39	3
COURSE TYPE	SPECIALIZATION			
COURSE REUIREMENTS:	-			
TEACHING AND EXAMINATION LANGUAGE:	ENGLISH			
IS THIS COURSE OFFER TO ERASMUS STUDENTS	YES (IN ENGLISH)			
COURSE WEBPAGE (URL)	https://eclass.uniwa.gr/courses/298/			

(2) LEARNING OUTCOMES

Learning outcomes

Course Objectives:
The purpose of this course is to introduce the science of biomedical engineering. The course will define the scope of biomedical engineering and analyze key areas of biomedical engineering, such as biomedical instrumentation, medical imaging, medical signal and image processing, biomedical informatics, biomedical optics, biomaterials, neuroengineering, ethics in biomedical research. Finally, the career prospects and job roles of a biomedical engineer will be analysed.

Learning Outcomes:

1. A comprehensive understanding of the scientific field of biomedical engineering, knowledge of definitions and key concepts.
2. Distinguish and describe the main areas of biomedical engineering.
3. Identify, describe and compare the roles of biomedical engineers in the labour market.

Achievement of Course Objectives and Learning Outcomes:
To fulfill the above objectives and learning outcomes, students will be taught basic definitions and concepts of biomedical engineering with reference to historical development. They will be taught the key areas of biomedical engineering, career prospects of biomedical engineering, research, and ethical issues and regulatory frameworks governing medical devices. In particular, the areas of medical imaging, biomedical instrumentation, biomaterial and tissue engineering, biomedical optics, neuroengineering and biomedical informatics will be analysed.

General abilities

- Search, analysis and synthesis of data and information, using the necessary technologies
- Adaptation to new situations
- Decision-making
- Autonomous work
- Teamwork
- Working in an international environment
- Working in an interdisciplinary environment

(3) COURSE CONTENT

"Introduction to biomedical engineering"
Definitions, basic concepts, history, scientific fields of biomedical engineering, professional fields of biomedical engineering, research in biomedical engineering, ethical issues, regulatory frameworks governing medical devices and technologies.

"Medical imaging"
Definitions, basic concepts, history, non-invasive imaging systems using ionising and non-ionising radiation (X-ray radiography, X-ray Computed Tomography, mammography, ultrasonography, MRI, SPECT, PET), research in medical imaging.

'Biomedical instrumentation'
Definitions, basic concepts, sensors, preamplification, amplification, conversion of analogue signals to digital, signal modulation, biosignal recording systems, in vitro and in vivo diagnostic systems, therapeutic systems, biomedical systems design, biomedical instrumentation research.

"Biomaterials and tissue engineering"
Definitions, basic concepts, introduction to biomaterials and tissue engineering, properties, basic materials and classes of biomaterials, biocompatibility and other characteristics, design and production, advanced materials and technologies, research in biomaterials.

'Biomedical optics'
Definitions, basic concepts, introduction to biomedical optics, interaction of light with biological materials, optical systems in biomedical engineering, microscopes, lenses, and other optical components, principles and techniques of medical imaging, optical methods for disease detection and diagnosis, research in biomedical optics.

"Neuroengineering"
Definitions, basic concepts, introduction to neuroengineering, nervous system, types of signals: electrical, chemical, optical, techniques for acquisition and processing of signals, neuroimaging technologies, implants, research in neuroengineering.

"Biomedical informatics"
Definitions, basic concepts, medical signal and image processing, biostatistics and bioinformatics, machine learning and artificial intelligence, applications in biomedical engineering, research in biomedical informatics.

"Professional rehabilitation and career of biomedical engineers"
Definitions, key concepts, job market studies, the role of biomedical engineer in repair, maintenance, design, quality control of medical devices, the role of biomedical engineer in sales and marketing of medical devices, the role of the biomedical engineer as an application specialist, the role of the biomedical engineer in the hospital environment, the role of the biomedical engineer in business administration and health economics, the role of the biomedical engineer as a researcher, biomedical engineers and start-ups, other roles of the biomedical engineer.

(4) TEACHING AND LEARNING METHODS - EXAMINATIONS

COURSE DELIVERY	Physical presence, face to face at the auditorium
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	The course involves the use of a projector for presenting fundamental concepts and is supplemented by the use of the blackboard at the auditorium.
TEACHING ORGANIZATION	

Activity	*Semester workload*
Teaching / lectures	39
Lecture material study	30

	Unsupervised literature review and preparation of the final project	56
	Total	***125***
STUNDET EVALUATION	100% Final exam paper with multiple-choice questions, short-answer questions, and problem-solving questions.	

(5) SUGGESTED LITERATURE

Books, scientific articles and related scientific resources:

[1] Bronzino, J., Biomedical Engineering - A historical perspective. Biomedical Engineering, 2005: 1-29.
[2] J. Webster, Medical Instrumentation: Application and Design, Wiley; 4th edition, 2009.
[3] R.S.Khandpur , Handbook of Biomedical Instrumentation, McGraw Hill Education, 2014.
[4] G. Zouridakis, Biomedical technology and devices handbook, CRC Press, 1st edition, 2003.
[5] Mummolo, G., The future for industrial engineers: education and research opportunities, European Journal of Engineering Education, 2007. 32(5): p. 587-598.

Scientific journals:

[1] Research on Biomedical Engineering, https://link.springer.com/journal/42600.
[2] IEEE Transactions on Biomedical Engineering, https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=10.
[3] Journal of Biomedical Instrumentation and Applications, https://norcaloa.com/BMIA.
[4] Biomedical Sciences Instrumentation, https://journal.rmbs.org/index.php/BiomedSciInstrum.
[5] IEEE Reviews in Biomedical Engineering, https://www.embs.org/rbme/.