ETE904 - Biomedical Engineering

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETE904	**SEMESTER**	6th
COURSE TITLE	Biomedical Engineering		

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**
Lectures	3	3
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General Background / Specialised General Knowledge
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	http://medlab.cc.uoi.gr/?page_id=6289

(2) LEARNING OUTCOMES

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*

Knowledge: As part of the course "Biomedical Engineering" students are introduced in various fields of biomedical engineering and the different ways that engineering is applied in medicine. Initially, basic physiological elements of the human body and its biomechanical properties are studied. More specifically, problems of statics and deformations in the human body are examined along with movement analysis, with an emphasis on the function of muscles and joints of the human body. The hard and soft tissues of the human body are then examined and the corresponding models for their physiological and computational analysis are provided. The mechanical properties of the heart and blood vessels are examined in more detail, as well as the properties of the human brain and its bioelectrical activity. Modeling examples of all the above biological systems are also analysed.

Skills: The obtained knowledge will allow the students to be able to solve static and kinetic problems in the mechanics of the human body, to determine the mechanical, structural, and functional properties of human body tissues, which they can be modeled in detail using appropriate mathematical and computational techniques.

Students will also have the opportunity to expand their knowledge into a specific topic related to biomedical engineering and biomechanics, and to understand the existing literature in the topic.

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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

General student skills that this course contributes to:

- Searching, analysing and making use of available data and information, using the appropriate technologies.
- Use and development of mathematical and computational models to simulate biological tissues and their functions.
- Independent research.
- Production of new research thoughts and ideas.
- Design and management of research activities.
- Formulating critical thinking and self-critique.
- Promoting free, creative and inductive thinking.

(3) SYLLABUS

This course is introductory to Biomedical Engineering. It covers fundamental concepts related to all primary human tissues, but with an emphasis on bones, blood vessels and blood circulation. Similar courses are offered in engineering departments at all Universities abroad, while some institutions are even providing degrees related to biomedical engineering at undergraduate and postgraduate level. The teaching of this course is based on the international experience and the existing experience in the Department of Materials Science and Engineering, and includes the following:

- Physiology of the human body
- Fundamentals of Engineering and Biomechanics
- Bioelectric phenomena
- Mechanics of hard human tissue
- Mechanics of blood vessels
- Mechanics of soft human tissue
- Cardiovascular models and control

Teaching is performed by presenting the theoretical background and actual mechanical problems in practice.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY Face-to-face, Distance learning, etc.</td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• In teaching, by presenting slides which will be made available to students.
• In the preparation of homeworks.
• For all teacher-student communications.</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Research project</td><td>16</td></tr>
<tr><td>Homework</td><td>20</td></tr>
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<tr><td>Total for this course</td><td>75</td></tr>
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<tr><td>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.</td><td>Student evaluation is performed in Greek.

Students can choose to be evaluated with written exams at the end of each semester.

Alternatively, those who are willing to be exempt from the written exams can be assigned to complete research projects that include:
• Presentation of a specific topic
• Written essay that will present all the necessary information on the assigned topic, along with extensive literature references (in the form of a Power-Point file).

The final grade will be determined by the student’s engagement throughout the course and percentage wise is estimated as:
• research project 100 %
• or written exams 100 %</td></tr>
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(5) ATTACHED BIBLIOGRAPHY

The main book for this course is:

- Χ. Μασσαλάς, Β. Ποτσίκα, Δ. Φωτιάδης, Εισαγωγή στην Εμβιομηχανική, Εκδόσεις Gutenberg, Αθήνα 2018.

All teaching materials and slides being used during this course will be available to the students. It should be noted that teaching involves the use of computer.

Additional books recommended for reading:

- Introduction to Biomedical Engineering, John Enderle, Susan Blanchard, Joseph Bronzino, Second Edition, Elsevier Academic Press, Amsterdam, 2005.
- Principles and Models of Biological Transport, Friedman, Morton H. 2nd ed., 2008, Springer Verlag.

- Biomedical Engineering, W. Mark Saltzman, Cambridge University Press, 2009.
- Εισαγωγή στη βιοϊατρική τεχνολογία και ανάλυση ιατρικών σημάτων, Κουτσούρης, Διονύσης – Δημήτρης, Παυλόπουλος, Σωτήρης Α., Πρέντζα, Ανδριάνα Α., Εκδόσεις Τζιόλα, 2003.