ΜΟΝΑΔΑ ΔΙΑΣΦΑΛΙΣΗΣ ΠΟΙΟΤΗΤΑΣ Α.Π.Θ.

Biomechanics

1. GENERAL			
SCHOOL	Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki		
DEPARTMENT	Materials Science and Engineering		
LEVEL OF STUDIES	ISCED level 7 (5-year Integrated Master's programme) ISCED level 6 (4-year BSc programme)		
COURSE CODE	MSEN 832	**SEMESTER**	8th Semester
COURSE TITLE	**Biomechanics**		
TEACHING ACTIVITIES Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.		**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
		4 (3L + 1T)	6
COURSE TYPE	Scientific area / Skill development		
PREREQUISITES	Introduction to Solid Mechanics (or equivalent); recommended: basic Biology/Biochemistry for engineers.		
TEACHING AND EXAMINATION METHODS	Lectures and problem sessions; case studies on tissues and implants; final written exam and a short analytical assignment.		
COURSE OFFERED TO ERASMUS STUDENTS	Yes (taught in English, subject to minimum enrollment).		
COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx		

2. LEARNING OUTCOMES	
Learning Outcomes	• Apply continuum mechanics concepts (stress, strain, constitutive laws) to biological tissues and systems. • Describe structure-property relations of key tissues (bone, cartilage, tendon, ligament) at multiple scales. • Analyze simplified biomechanical models (beams, pressure vessels, viscoelastic elements) for biological problems. • Explain mechanobiology concepts at an introductory level (mechanical cues and biological response). • Evaluate biomechanical considerations in implant/material selection (overview) and failure modes. • Communicate biomechanical analyses and assumptions clearly in written form.
General Skills	• Quantitative modeling and problem solving • Interdisciplinary integration (mechanics + biology + materials) • Critical thinking about assumptions and model limits • Technical communication and report writing

3. COURSE CONTENT

- Introduction to biomechanics: scales, loading, and modelling approaches.
- Review of stress/strain, constitutive models; anisotropy and incompressibility concepts (intro).
- Mechanical behavior of biological tissues: viscoelasticity, poroelasticity concepts (intro).
- Bone biomechanics: structure, remodeling (intro), fracture and fatigue concepts.
- Soft tissue biomechanics: tendon/ligament; cartilage basics; muscle mechanics (overview).
- Cellular mechanobiology overview: adhesion, cytoskeleton, mechanotransduction (intro).
- Biomechanics in medical devices and implants: materials and design considerations (overview).
- Experimental methods overview: mechanical testing of tissues; imaging and digital image correlation (intro).
- Case studies and problem sets.

4. LEARNING & TEACHING METHODS - EVALUATION

Teaching method	Face-to-face. Lectures combined with guided problem sessions and discussion of biomedical case studies.
Use of ICT	E-learning for notes/problem sets; spreadsheet/Python tools for simple model calculations; video demonstrations of biomechanical experiments.
Teaching organization	The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).
Student evaluation	Assessment language: English. Methods: written final exam (65%), analytical assignment/report (20%), quizzes/problem sets (15%). Students are informed via the course guide and e-learning announcements.

Activity	Workload/semester (hours)
Lectures	39
Tutorials / problem sessions	13
Analytical assignment / report	16
Independent study	64
Exam preparation	16
Final written exam	2
Total	**150**

5. SUGGESTED BIBLIOGRAPHY

EUDOXUS

To be specified in EUDOXUS.

Additional bibliography for study

- Y.C. Fung, Biomechanics: Mechanical Properties of Living Tissues.
- S.C. Cowin (ed.), Bone Mechanics Handbook (selected chapters).
- D. Dowling, Mechanical Behavior of Materials (selected sections, for review).
- Selected open courseware notes (indicative): MIT / UC Berkeley biomechanics course materials.