COURSE OUTLINE

(1) GENERAL INFORMATION

SCHOOL	FACULTY OF ENGINEERING		
DEPARTMENT	ELECTRICAL AND COMPUTER ENGINEERING		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE		**SEMESTER**	**2o**
COURSE TITLE	MEMS (Micro-Electromechanical Systems)		
COURSEWORK BREAKDOWN		**TEACHING WEEKLY HOURS**	**ECTS CREDITS**
Lectures		3	5
Add extra space if necessary			
COURSE TYPE Scientific field *special knowledge* Development of special skills	Compulsory/Elective		
PREREQUISITES:			
LANGUAGE OF INSTRUCTION and EXAMS:	Greek		
COURSE AVAILABLE TO ERASMUS STUDENTS:	yes		
COURSE WEB PAGE (URL)			

(2) LEARNING OUTCOMES

Learning Outcomes
Upon successful completion, students will: **1. Understand principles of MEMS design, fabrication, and material selection.** **2. Simulate and analyze MEMS devices using CAD and finite element tools (e.g., COMSOL, ANSYS).** **3. Apply microfabrication techniques (lithography, etching, thin-film deposition).** **4. Integrate MEMS sensors/actuators into mechatronic systems (e.g., robotics, automotive).** **5. Evaluate reliability, scalability, and ethical considerations in MEMS production.**

General Skills

Interdisciplinary problem-solving in MEMS-mechatronic integration.

- Team collaboration for device prototyping and testing.
- Use of simulation software and microfabrication lab tools.
- Critical evaluation of MEMS applications in industry and research..

(3) COURSE CONTENT

Part 1: MEMS Fundamentals

1. Introduction to MEMS: Principles, scaling laws, materials (silicon, polymers, piezoelectric).

2. Fabrication Processes: Lithography, etching (wet/dry), deposition (CVD, PVD).

3. MEMS Actuators and Sensors: Electrostatic, thermal, piezoelectric.

Part 2: Design and Simulation

1. MEMS Modeling: Finite element analysis (FEA), dynamic response.

2. CAD Tools: COMSOL Multiphysics, ANSYS for MEMS design.

3. Reliability and Failure Modes: Fatigue, stiction, environmental effects.

Part 3: Applications in Mechatronics

1. MEMS in Robotics: Accelerometers, gyroscopes, micro-actuators.

2. Automotive and Biomedical Applications: Pressure sensors, lab-on-a-chip.

3. Case Studies: MEMS in drones, wearable devices, and IoT systems.

(4) TEACHING and LEARNING METHODS - ASSESSMENT

COURSE DELIVERY MODE *lectures, face-to-face, distance learning etc.*	Lectures, labs, and project-based learning
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY *e.g. use of audiovisual media and computers etc.*	**MEMS simulation software (COMSOL, ANSYS) & Matlab**
TEACHING METHODS *Derailed description of the teaching methods used:* *Lectures, Seminars, Laboratory exercises, Study & bibliography analysis, Tutoring, Internship/Practicum, Art Workshop, Interactive Teaching, Projects, Written Assignments, Artistic creation etc.* *Study hours for each learning activity are included along with the non-guided study hours according to the ECTS principles*	

Method Description	***Semester workload***
Lectures and tutorials	39
Individual project	70
Individual Study	41
Total	***150***

ASSESSMENT METHODS AND CRITERIA *Description of the assessment methods and criteria:* *Language of Assessment, Assessment Methods, Formative or Concluding Assessment, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Reports, Oral Exam, Essay, Oral Presentation, Clinical Examination of patient, Artistic Performance, Others* *Assessment criteria are explicitly defined and stated.*	I. Written final examination (80%) including - Multiple choice questions - Multiple Choice Questions - Multi-choice essay questions Short answer questions - Comparative assessment of theoretical elements - Laboratory work II. Presentation of individual/group work (20%)

(5) RECOMMENDED BIBLIOGRAPHY

- Recommended Bibliography:

Chang Liu (2020). Foundations of MEMS. Pearson.
- *Tai-Ran Hsu (2008). MEMS and Microsystems: Design and Manufacture. Wiley.*
- *Stephen D. Senturia (2001). Microsystem Design. Springer.*

Related Journals/Conferences:
- Journal of Microelectromechanical Systems (JMEMS)
- Sensors and Actuators A: Physical
- IEEE International Conference on Micro Electro Mechanical Systems (MEMS)