CAD/CAM SYSTEMS, 3D MODELING AND REVERSE ENGINEERING

COURSE OUTLINE

Responsible: Emmanouil Maravelakis

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0806.7.014.0	**SEMESTER**	1st
COURSE TITLE	CAD/CAM Systems, 3D Modeling and Reverse Engineering		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
Seminars	4	5
Total	**4**	**5**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Επιλογής υποχρεωτικό
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	
OFFERED TO ERASMUS STUDENTS	Yes (in English) — Winter Semester
COURSE WEBSITE (URL)	https://iro.hmu.gr/introduction-to-history-of-crete-and-greece-electronic-engineering-courses/

2. LEARNING OUTCOMES

Learning outcomes

- Identify and describe the main stages of the product development process and determine the appropriate digital tools for each phase.
- Explain the various applications of 3D models, including production of photorealistic images, CNC machining, finite element analysis (CAE/FEM), rapid prototyping/additive manufacturing (RP/AM), and virtual reality.
- Analyze the principles of concurrent and collaborative engineering and evaluate their contribution to product development time optimization.
- Design products using parametric modeling and geometric features.
- Manage complex assemblies and design sheet metal components.
- Evaluate reverse engineering applications in specialized fields such as medicine, quality control, documentation of obsolete components, and cultural heritage preservation.
- Select the appropriate Computer-Aided Manufacturing (CAM) system for product manufacturing.

General Competences

- Search, analysis and synthesis of data and information, using the CAD/CAM technologies
- Decision making
- Autonomous work
- Teamwork
- Project design and management

- Promoting free, creative, and inductive thinking

3. SYLLABUS

Introduction to Computer-Aided Design and Manufacturing (CAD/CAM) systems,.CAD tools for mechanical product design and manufacturing, CAD tools for electronic applications, industrial design, and CAM tools. Process planning and CNC programming. Product design, 3D modeling, and functional analysis using Computer-Aided Engineering (CAE) and Finite Element Analysis (FEA). Evolution of CAD systems, industrial applications of CAD/CAM technologies, typical CAD/CAM workflows in manufacturing environments. 3D product models and their applications. Introduction to 3D CAD modeling, feature-based parametric modeling, sheet metal design, assemblies, and data exchange between CAD systems. Introduction to reverse engineering. Contact and non-contact 3D data acquisition techniques. Structured-light and laser 3D scanners, scanning methodologies, and best practices. Low-cost 3D modeling techniques using photogrammetry. Large-scale terrestrial laser scanning & applications. Medical applications based on computed tomography (CT) and magnetic resonance imaging (MRI) data. Closed-surface (watertight) 3D models. Applications of 3D models in Virtual Reality (VR), Augmented Reality (AR), and multimedia. Applications of 3D documentation and digital preservation in cultural heritage.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY Face-to-face, Distance learning, etc.	Classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	
TEACHING METHODS The manner and methods of teaching are described in detail.	
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	I. Written final exam (WFE) (80%) - General questions - Problem solving / calculations - Comparative evaluation of theory elements II. Individual Project (IP) (20%) - Laboratory work / technical reports / measurements in small groups

Activity	Semester workload
Lectures	26
Laboratory exercises	26
Individual study	59
Preparation of laboratory work / technical reports in small groups	39
Course total	**150**

5. ATTACHED BIBLIOGRAPHY

- Warren, T. (2026). *Autodesk Fusion 360 for beginners 2026: Step-by-step CAD, 3D modeling, and CAM made simple for students, makers, and hobbyists*. Independently published.
- Merton, J. (2026). *Master FreeCAD 1.1.1 2026: A step-by-step beginner's guide to parametric 3D design from scratch*. Independently published
- Sugden, J. O., & Manley, J. (2024). *Mastering Autodesk Fusion 360* (2nd ed., 2024–2025): 27 step-by-step projects for beginners in 3D printing, prototyping, and making. Sliceform LLC.