Πανεπιστήμιο Δυτικής Αττικής

Σχολή Μηχανικών

Τμήμα Μηχανολόγων Μηχανικών

Α8

Οδηγός Σπουδών του ΠΜΣ

MSc Advanced Product Design Engineering and Manufacturing

(ΠΜΣ Προηγμένα Βιομηχανικά Συστήματα Παραγωγής)

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Introduction

The Department of Mechanical Engineering of the University of West Attica, organizes and operates a Master of Science (MSc) Program titled "Advanced Product Design Engineering and Manufacturing", in accordance with the provisions of Law 4957/2022 (Government Gazette 141A'), as modified and in effect by Law 5094/2024 (Government Gazette 39A'). The program is delivered in English language. The MSc Program of the Mechanical Engineering Department is part of the objectives and the general mission of the University of West Attica (UniWA). It aims at the further advancement of scientific knowledge, the development of research and the high-level specialization of graduates in theoretical and applied areas of the field of Advanced Industrial Production Systems, which is core topic of the Department of Mechanical Engineering.

Aim - Structure and operation of the MSc

The objective of the MSc Program is the postgraduate teaching, research and application of methods from state-of-the-art technologies in the related fields of modern Industrial Product Design, in combination with Manufacturing Management. The MSc is governed by scientific coherence, has a subject related to the scientific fields of the Department that organizes it and meets the requirements that guarantee a high level of study. During its establishment, emphasis will be placed on the subjects that are on a significant rise in the current period in the field of engineering, such as Additive and Subtractive Manufacturing, Artificial Intelligence (AI), new materials, Reverse Engineering (RE), Mechatronics and Robotics.

The aim of the MSc, which is addressed to higher education graduates, is to integrate modern manufacturing methods with production. It offers specialization in the field of Industrial Production Systems aiming at:

- equipping engineers with all necessary skills on modern methods used in manufacturing
- to enhance the rational and effective approach to modern issues of industrial production
- to develop and expand the managerial skills of engineers for professional success in the private, public and academic sectors in all MSc topics

The MSc implements a combination of in-depth studies in state-of-the-art technologies (CAD/CAM/CAE, Additive Manufacturing, Artificial Intelligence, Reverse engineering, Mechanical Engineering, Robotics, new materials), combined with courses in Quality Management and Production Line Optimization, Project Management, Research Methods and Product Development and Production.

Learning Outcomes of the MSc

Upon successful completion of the program, students will be able to:

- Deepen their knowledge in specialized topics of the subject of Mechanical Engineering to promote knowledge, the development of research and the arts, as well as the satisfaction of the educational, research, social, cultural and developmental needs of the country,
- Expand and develop smooth partnerships at educational, research and, by extension, working level
- Analyze problems, compose solutions and evaluate comparatively alternative approaches in specialized fields of engineering,

- Develop problem-solving skills and the ability to apply these skills in developing innovative solutions for the actual needs of society.
- Analyse problems, formulate solutions and comparatively evaluate alternative approaches,
- Have developed and actively demonstrate an awareness of the ethics and rules of research, of the personal, social, economic and environmental aspects and consequences and identify unresolved issues and related challenges.
- describe and present their work and its results in a proper, accurate and concise manner, in an individual or group context and in an oral, written or other supervisory way
- be inspired to produce and apply new ideas and new methodological approaches in the field of industrial production
- develop their research interests to continue their studies in the third cycle of doctoral studies in specialized fields within the field of Mechanical Engineering.

Duration of Studies - Part-time Studies - Suspension of Studies

Duration of study

According to its philosophy, this MSc is addressed to working students. For this reason, attendance is offered twice a week in the evening and/or during the weekend. Attendance of the courses in this MSc is compulsory.

The duration of the studies, leading to the award of the MSc is set at three (3) academic semesters and the additional time is set at two (2) semesters, each of thirteen (13) weeks of teaching, including the time for the preparation and submission for examination of the Postgraduate Dissertation.

The permitted duration for completing the requirements for the Master's degree is set a minimum three (3) up to five (5) academic semesters. However, in exceptional cases, a suspension of study may be granted upon recommendation of the Coordinating Committee and decision of the Departmental Assembly, and this time shall not be counted towards the total required duration of the MSc.

The duration of the courses of the MSc per semester of study is at least thirteen (13) weeks, corresponding to thirty (30) ECTS. The compulsory courses shall not be less than thirty-nine (39) credit hours. The time for writing the thesis cannot be less than six (6) months and more than eighteen (18) months.

The MSc is completed with the award of a Diploma of Postgraduate Studies (MSc) at level seven (7) of the National and European Qualifications Framework, in accordance with article 47 of Law No. 4763/2020.

Successful completion of studies is assessed by the successful performance in the courses of the MSc and the successful completion of the Dissertation.

Part-time Studies

For postgraduate students who are unable to meet the minimum requirements of the full-time programme, the possibility of part-time study is provided in accordance with the applicable legislation.

In the case of part-time studies, the duration of studies may not exceed twice the duration of full-time studies.

The option of part-time study may be given to working students for reasons of illness, serious family reasons, military service and reasons of force majeure. The possibility of part-time attendance is granted after a reasoned request by the student and approval by the Curriculum Committee (CC). The

application must be accompanied by the relevant supporting documents documenting the reason for which part-time attendance is requested.

Suspension of Attendance

Students may justify request a study break, which is approved by the AC for full academic semesters. Regardless the application date, the break shall start from the beginning of the next academic semester. These semesters are not added towards the maximum period of regular study, provided for above. The break must not exceed two (2) semesters in total.

Students may request a reasoned suspension of studies, which is granted by the Coordinating Committee for entire academic semesters. Regardless of the submission time of the application, the suspension shall start from the beginning of the next academic semester. The semesters of student suspension do not count towards the maximum period of regular study provided for above. Suspension may not exceed two (2) semesters in total. Students who are on suspension shall not be considered postgraduate student status for the entire period of suspension. Upon resumption of attendance, the student shall continue to be subject to the attendance status of the time of his/her enrollment as a graduate student.

Course of Studies

The curriculum of the MSc is equivalent to ninety (90) ECTS credits. Each course corresponds to a specific number of credits. During their studies, the student is required:

a. to successfully complete a total of six (6) modules; and

b. to complete a Postgraduate Dissertation

The standard curriculum is as follows:

Co	Module Title	S	T	ECTS
M1-01	**Advanced Engineering Design (CAD/CAE)**	1	C	10
M1-02	**Quality Engineering & Project Management**	1	C	10
M1-03	**Robotics and Smart Manufacturing**	1	C	10
M1-04	**Additive and Subtractive Manufacturing & Reverse Engineering**	2	C	10
M1-05	**Dissertation**	3	C	30
Total ECTS of compulsory modules				*70*
Compulsory choice two modules (between M2-1,M2-2,M2-3)				
M2-01	**Mechatronic Design & Industrial Control**	2	O	10
M2-02	**AI - Applications in Engineering**	2	O	10
M2-03	**Advanced CAD/CAE Methods**	2	O	10
Total ECTS of optional modules				*20*
Overall ECTS Total				*90*

Key:
Co: Module Code S: Semester   T:Module Type   C:Compulsory   O:Optional

Teaching Methods - Assessment

All modules delivered through a combination of lectures, hands-on applications and case studies. The main feature of the strategy is the allocation of workshops to enable students to apply the concepts of all delivered topics. Relevant industrial case studies are also provided to develop students' skills.

Teaching notes, independent guided reading and other supplementary material will be available on-line and accessible via the module website. Assessment tasks will be incorporated into the syllabus to provide students with feedback-based evaluation.

Detailed course outlines, Distribution of learning and teaching hours, assessment methods and the calculation of the final grade for each module are contained in the Course Outline.

In order to successfully complete the program, the student must have successfully completed all the module deliverables.

Modules Summary

Modules Summary
1ˢᵗ Semester
Advanced Engineering Design (CAD/CAE) *This module is structured to provide an in-depth understanding of fundamental CAD/CAE technologies that support the product development process. The module develops an understanding of the role of these technologies in integrated product development.* *The structure of the course provides the student with approximately 50% of the teaching time to focus on practical CAD/CAE applications. This will enable students to acquire a skill set that will enhance their employment prospects in the demanding field of Industrial Manufacturing. The core material is provided with lectures used to elaborate on concepts of integrated CAD/CAE systems.*
Quality Engineering & Project Management *This course is designed to provide to students with the necessary knowledge to ensure that products and services have the quality they have been designed for. This approach to managing quality throughout the organization has evolved into what is generally known as Quality Management Systems (QMS). The focus of this module is to provide students with an understanding of the fundamental principles of QMS and how to implement it using a range of tools and techniques.* *This module will start off with the overview of QMS with an emphasis on ISO 9000 series which is a key building block in an organisation's approach to total quality management (TQM) and strategic process improvement (SPI). This will lead to the next topic which is the selection of tools and techniques, and the typical problems found in their use and applications. The next part of this module will cover key concepts of specific quality management techniques such as quality function deployment (QFD), design of experiments (DoE), failure mode and effects analysis (FMEA), statistical process control (SPC), benchmarking and Six Sigma. In the last part of the module there will be an in-depth study of industry-oriented project management topics, through the use of dedicated software. All these will be vital in enhancing the learners' employability skills, especially those who wish to partake in the Quality Management sectors.*
Industrial Robotics and Smart Manufacturing

The module provides mechanical engineers with an in-depth understanding of the role of robotics in smart manufacturing environments, focusing on the integration of Industry 4.0 principles such as artificial intelligence (AI), real-time data analytics, and advanced automation. The course will cover the design, kinematics, control, and optimization of robotic systems and Automated Guided Vehicles (AGVs) within smart factories, emphasizing their role in enhancing flexibility, adaptability, and efficiency in production. Finally, there will be an in-depth look at production planning topics.

2nd Semester

Additive and Subtractive Manufacturing & Reverse Engineering

The module covers modern manufacturing methods and focuses on additive manufacturing (Additive Manufacturing-AM), subtractive (Computer Aided Manufacturing-CAM) and Reverse Engineering (RE). The module covers advanced modeling and manufacturing methods from initial design through manufacturing. It focuses on additive and subtractive manufacturing methods, machining toolpath optimisation & machining simulation and verification. Collision detection and avoidance during machining operations will also be covered.

The course is structured in such a way that 50% of the teaching and learning time is focused on hands-on AM, CAM and RE laboratory work. This will enable students to acquire a skill set that will enhance their employment prospects in the demanding Industrial sector. The core material is delivered through synchronous and asynchronous learning platforms while the core lectures are used to explain the concepts of integrating CAM systems, AM technologies and RE processes in Industrial Production

Mechatronic Design & Industrial Control

This module provides high-level knowledge for the design of mechatronic and automation systems. Applications and types of such systems are discussed. The main components of mechatronic design are presented, including mechatronic design through specialized software, sensors and actuators, control design, and software development for real-time implementation. Analysis of PLC systems for both their operation and programming is also carried out. Theory is implemented in applications through hands-on practical laboratory examples.

AI-Applications in Engineering

This module is structured in such a way that it provides fundamental knowledge of Artificial Intelligence (AI) and its applications in advanced design and industrial manufacturing. It provides students with a comprehensive understanding of how AI techniques can be integrated into manufacturing processes to improve efficiency, innovation and productivity. The course covers state-of-the-art use cases in Industrial Robotics, Additive Manufacturing, modeling, CAD/CAE systems-assisted manufacturing analysis, and mechatronics. It aims to prepare students to become competent professionals who will contribute to innovation and development in the field of engineering through artificial intelligence

Advanced CAD/CAE Methods

The module covers modern automation and computation techniques through CAD/CAE programming interface (Application Programming Interface-API) as well as the use of Topology Optimization (TO) and Generative Design Technologies (GD). It focuses mainly on CAD systems

programming methods as well as the connection of TO and GD technologies in the production of AM products.

The course is structured so that over 50% of teaching and learning time is focused on hands-on workshops and activities. This will allow students to acquire a set of skills that will enhance their employment prospects in the demanding Industrial sector. The core material is provided through synchronous and asynchronous learning platforms while the keynote lectures are used to explain the concepts of integrating CAD API, TO and GD systems into the development of Industrial products.

3rd Semester

Dissertation

The Dissertation module forms a capstone experience for the MSc course. Drawing on previous knowledge and experience, the Dissertation module allows students to study an area of interest, within their chosen field, in significant depth. In undertaking the Dissertation students will develop not only a deeper understanding of their subject area, but will also be able to demonstrate a high level of autonomy in terms of dissertation planning and management. They will be able to demonstrate knowledge and competence in reviewing existing published literature and data and, through their own efforts, apply one or more of a range of research methods to collect and analyse data and draw well-founded conclusions as a result of their research. All students are encouraged to propose an issue (problem) from their working environment and the main output is a final report. All students are obliged to prepare their work as an article, suitable for submission to a relevant conference or journal.

The intense course structure provides students with the opportunity to identify an industry-based (or research-focused) project area, create a feasible hypothesis, find worthwhile solutions, analyze the results, and propose recommendations. The module enables the student to acquire and evaluate new knowledge and apply individual judgement to solve new and often complex engineering problems using cutting-edge technology. It also enables him/her to demonstrate high levels of responsibility, organisational skills and effective communication with others, including the supervisor, the wider research community and other stakeholders. The course also encourages students to recognize, question and address the ethical dilemmas that are likely to arise in professional engineering practice and research.

Plagiarism

The postgraduate student is required to report in an appropriate manner if he/she has used the work and opinions of others. In addition, postgraduate students who have used the services and assistance of Artificial Intelligence (AI), in the preparation of work assigned to them within the framework of the MSc and/or Dissertation, should include in the introduction a "Statement on the use of generative AI and AI-assisted technologies in the writing process", stating which tool they have used and for what purpose.

Plagiarism is considered a serious academic offence. Plagiarism is the copying of someone else's work, as well as the use of someone else's work - published or not - without proper citation. The copying of any documentary material, even from the candidate's own studies, without proper reference, may lead to a decision by the Department to expel the candidate. In the above cases, the Department may

decide to remove the candidate after he/she has been given the opportunity to express his/her views on the matter, either orally or in writing.

Any offence or breach of academic ethics shall be referred to the Department to address the problem. Offences of copying or plagiarism and, in general, any violation of the provisions on intellectual property by a postgraduate student when writing coursework or preparing a thesis are also considered as offences.