

Major	Mechanical Engineering		
Master's programme	MATERIAL AND ENGINEERING SCIENCES		
Master's Code	MMSP-I2M		
Qualification awarded	Master in Mechanics of Materials, Structures and Processes		
Programme director	Fodil MERAGHNI (fodil.meraghni@ensam.eu)		
Mode of study	Level of qualification	Field of study	Language of study
Full time	Master ISCED 7	Engineering ISCED-F-07	French and English
ECTS	Campus	Length of programme	Specific arrangements for recognition of prior learning
60	Metz	End-September to end-January (courses) beginning-February to end June (Master Internship), defense on July and/or September	No
Keywords	Solid mechanics, Materials science, Innovative processes, Mechanical engineering, Composites, Metallurgy, Metals and alloys, Modelling and simulation, Multiscale and homogenization, Advanced experimental methods.		

Admission requirements

Type	Level	Way
French proficiency	Level B2	Certificate
English proficiency	Level B2	Certificate
Previous degree	First year of Master of Science degree , or equivalent, in Engineering.	Certificate of achievement

Applicants interested in the MMSP-I2M master programme must follow the online procedure and adhere to the schedule.

<https://artsetmetiers.fr/en/formation/master-admissions>

Overall objectives

The MMSP-I2M master programme aims at providing students with a deeper understanding of solid mechanics and materials engineering. The main objectives are:

- Understanding and modelling the links between: multimaterials microstructures and properties, structures performance and integrity, and manufacturing processes technologies, using both experimental techniques and multiphysics and scale transition modelling.
- Developing skills on the related Data analysis including digitalization that can be applied for advanced industrial applications and innovative processes.

Programme learning goals

The table below details the abilities to be acquired and the expected proficiency levels according to the following grading scale:

- 1) A hands-on approach combined with a high level of scientific contents leading to highly valued expertise in innovative multimaterials, computational analysis and innovative manufacturing processes.
- 2) A broad comprehensive coursework preparing the students to lead innovative multidisciplinary projects dealing with design, structural integrity and functional performances of manufactured industrial products.
- 3) Gain experience by being exposed to the future challenges of digitalization in mechanical engineering and materials science towards the industry of the future.
- 4) Applying transversal approaches combining multimaterials, structures performance and manufacturing technologies towards digitalization in collaborative framework.
- 5) Communicate clearly and concisely (by talk, poster, written report, etc.) in French and at least, one foreign language in front of an audience of specialists and non-specialists.

Sets of expected abilities	Expected abilities	Expected proficiency level
		R&D
<i>Disciplinary knowledge and reasoning</i>	1.1 Knowledge of underlying mathematics and science	4
	1.2 Core fundamental knowledge of engineering	4
	1.3 Advanced engineering fundamental knowledge, methods and tools	4
<i>Personal and professional skills attributes</i>	2.1 Analytical reasoning and problem solving	4
	2.2 Experimentation, investigation and knowledge discovery	4
	2.3 System thinking	4
	2.4 Ethics, though and learning	4
	2.5 Ethics, equity and other responsibilities	4
<i>Interpersonal skills: Teamwork and communication</i>	3.1 Teamwork	3
	3.2 Communications	4
	3.3 Communications in foreign language	3
<i>Conceiving, Designing, implementing, operating, innovating and entrepreneurship in the context of Corporate Social Responsibility</i>	4.1 External, societal and environmental context	3
	4.2 Enterprise and business context	3
	4.3 Conceiving, systems engineering and management	4
	4.4 Designing	4
	4.5 Implementing	4
	4.6 Operating	3
	4.7 Leading engineering endeavours	4
	4.8 Engineering entrepreneurship	4

More specifically, the **key strengths** of the MMSP-I2M programme are as follows:

Programme structure

The MMSP MSc programme is a one-year programme that starts by the end of September and lasts two semesters. During the first semester, high-level courseworks are proposed. They consist in a well-balanced pedagogic offer combining theoretical and experimental modules (UE), which aim at developing transversal skills for multimaterials, structures performance and manufacturing technologies.

Lectures, practical hands-on and projects are focusing on three complementary main topics:

- Advanced experimental approaches for mechanics of heterogeneous materials,
- Computational methods and advanced modelling for materials and structures analysis,
- Materials engineering and advanced manufacturing processes: experiments and digitalization.

Each student should design his/her own training curricula by selecting 8 modules among an offer of 18 modules. The selected modules should include 5 modules dealing with core background of mechanics and materials engineering, as well as 3 others chosen among electives modules. The selection is based on his/her scientific interest and professional project. The academic curricula is completed by bibliographic review research project enabling the master student to be initiated to the research methods and tools.

Core and Fundamentals Module	ECTS
UE 920 – Experimental Methods in Solid Mechanics	3
UE 921 – Mechanical Behavior of materials	3
UE 922 – Thermomechanical behavior of heterogeneous materials	3
UE 923 – Continuum mechanics	3
UE 924 – Structural mechanics and finite element analysis	3
UE 925 – Numerical treatment of PDE	3
UE 926 – Phase transformation in metals and alloys	3
UE 927 – Deformation Mechanisms and microstructure	3
UE 939 – <i>Research project and publication review – Initiation to research processes and methods (mandatory)</i>	3
T1 <i>Scientific communication in English – How to publish a scientific paper and results (mandatory)</i>	3

Elective Module	ECTS
UE 925 - Numerical methods in computational mechanics	3
UE 928 – Mechanics of Fracture, Damage and Fatigue	3
UE 929 – Mechanics of Composite Materials and Structures	3
UE 930 – Control and damping of vibrations	3
UE 931 – Characterization and modeling of materials under dynamic regime	3
UE 932 – Machining Processes: Modeling and Experimentation	3
UE 933 – Tribology, friction, dynamic interactions	3
UE 934 – Micromechanics of crystalline defects	3
UE 937 – Powder Metallurgy Technology and Sintering	3
UE 938 – Metal forming	3

The second semester begins on February 1st and lasts 5 to 6 months. It is entirely devoted to the master thesis (research internship), which confers 30 ECTS. The internship is preferably carried out in an industrial environment or a research laboratory. Cooperations with a foreign institution are often offered to students.

Study and assessment rules

Each module can be evaluated by means of practical works, projects, reports, oral presentations, exams and the assessment rules are explained at the beginning of the programme by the director of the MSc programme. Each module assessment is graded between 0 and 20. Formative and summative assessments are adopted.

For students who fail the first session exams, makeup (revalidation) exams are organized at the beginning of the second semester (early February).

Graduation requirements

To get graduated, students need to comply with the following rules:

Master 2

- Validate 30 ECTS during the first semester
- Validate 30 ECTS during the second semester

Several honours grades are awarded (very good, good, fair, passable) only for students who succeeded in the first session exams.

Careers of graduates and access to further studies

Depending on their results and professional expectations, graduate students can continue their professional careers:

- In industry addressing applications in Aeronautics, transportation, energy, health technologies, manufacturing, plastics and composites, metallurgy.
- R&D engineer/researcher in large companies or start-ups, in numerous sectors (manufacturing, construction, services, consultancy, etc.) and fields (automotive, aerospace, health, etc.) in an area of the Industry 4.0
- Careers in academia while becoming researcher or professor in France or abroad