Major	Energy Engineering		
Master's programme	MECHANICAL SCIENCES & ENGINEERING		
Master's Code	SMI		
Qualification awarded	**Master's degree in Energy Engineering**		
Programme director	**Antoine DAZIN (antoine.dazin@ensam.eu)**		
Mode of study	*Level of qualification*	*Field of study*	*Language of study*
Full time	**Master ISCED 7**	**Engineering ISCED-F-07**	**French**
ECTS	*Campus*	*Length of programme*	*Specific arrangements for recognition of prior learning*
60	**ENSAM - Campus Lille Université de Lille Ecole Centrale de Lille**	**1 year (from September to September)**	**No**
Keywords	**Mechanical Engineering, Fluid Mechanics, Simulation, experimental Fluid Dynamics.**		

Admission requirements

Type	Level	Way
French proficiency	**Level B2**	**Certificate**
English proficiency	**Level B2**	**Certificate**
Previous degree	**First-year of Master's (M1) minimum, or equivalent, in Engineering**	**Certificate of achievement**

Applicants interested in the SMI programme must follow the online procedure and adhere to the schedule.

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

Overall objectives

The Program aims at training future engineers and researchers to :

- Model, Simulate and conduct experiments related to various problems of fluid and solid mechanics
- Deal with mechanical engineering problems by demonstratinginitiative, autonomy and originality
- Master written and oral communication.

Programme learning goals

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

1) Simulate a mechanical system with numerical tools
2) Model a mechanical system
3) Design an experimental set-up adapted to a scientifical problem

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

More specifically, the **key strengths** of the SMI programme are as follows:

- Deep theoretical knowledge on the mainstream concepts, methods, models and tools involved in mechanical Engineering
- Extended practical skills for the definition of multi-disciplinary technical solutions for CPS engineering
- Coupled approach associating modelisation and experiments
- Structured research methodology to be used as a template to address a wide range of mechanical engineering related research challenges

- Transversal adaptation, integration, analysis, critical thinking, self-learning, communication, valorisation and organizational skills gained when confronting to both academic and industrial multi-disciplinary projects

Programme structure

Learning outcomes are reached through a well-balanced training program that combines theoretical and practical learning sequences, during which students are placed in both academic and real-life configurations, in order to develop multiple transversal skills.

The SMI programme is a one-year Master programme that spreads on two semesters

- **First semester (S3): From September to January**
  This semester is composed of 4 professionalizing modules of 12h each, 6 scientific modules of 24h each, 1 language module of 24h, 1 long research project of 128h, for a total of 30 ECTS.
- **Second semester (S4): From February to September**
  The second semester is dedicated to the Master thesis of 6 months and 30 ECTS. The internship will be made in a research structure (laboratory or company) in France or abroad.

Code	Title	Sem.	Year	ECTS	Hours	Compulsory/ Optional	Teaching modalities
	Rappels et compléments des outils mathématiques pour l'ingénieur	S3	M2	1	20	Optional	Course/Exercises/Project
	Bases de la Mécanique des mileux continus	S3	M2	2	20	Compulsory	Course/Exercises/Project
	Mécanique non linéaire des matériaux et endommagement	S3	M2	3	20	Compulsory	Course/Exercises/Project
	Dynamique des Fluides Avancées	S3	M2	3	20	Compulsory	Course/Exercises/Project
	Méthodes Numériques 2D en Mécanique	S3	M2	3	20	Compulsory	Course/Exercises/Project
	Anglais	S3	M2	2	30	Compulsory	Course/Exercises/Project
	Instabilités, hydrodynamiques	S3	M2	2	20	Optional	Course/Exercises/Project
	Microfluidique	S3	M2	2	20	Optional	Course/Exercises/Project
	Turbomachine	S3	M2	2	20	Optional	Course/Exercises/Project
	Turbulence	S3	M2	2	20	Optional	Course/Exercises/Project
	Méthodes expérimentales en mécanique des fluides	S3	M2	2	20	Optional	Project
	Méthodes numériques avancées en Mécanique des Fluides	S3	M2	2	20	Optional	Course/Exercises/Project
	Logiciels de simulation numérique en Mécanique des Fluides	S3	M2	2	20	Optional	Course/Exercises/Project
	Ecoulements multiphasiques	S3	M2	2	20	Optional	Course/Exercises/Project
	Bio mécanique	S3	M2	2	20	Optional	Course/Exercises/Project

Code	Title	Sem.	Year	ECTS	Hours	Compulsory/ Optional	Teaching modalities
	Milieux hétérogènes	S3	M2	2	20	Optional	Course/Exercises/Project
	Elements finis	S3	M2	2	20	Optional	Course/Exercises/Project
	Logiciel de simulation en Mécanique des Solides	S3	M2	2	16	Optional	Course/Exercises/Project
	Mécanique du Contact	S3	M2	2	20	Optional	Course/Exercises/Project
	Aérodynamique des Véhicules	S3	M2	2	20	Optional	Course/Exercises/Project
	Interaction Fluide Structure	S3	M2	2	20	Optional	Course/Exercises/Project
	Stage	S4	M2	30	5/6 months	Compulsory	Internship/Master Thesis

Table 1 : Detail of the modules of the SMI programme over the two semesters.

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. Each module is evaluated between 0 and 20.

For professional and language modules

- The final mark of each professional/language module must be ≥ 10, and there is no compensation between the modules.

For scientific modules

- The final mark of each scientific module must be ≥ 8
- The average of the 6 scientific modules must be ≥ 10, thus there can be compensation between the scientific modules

For long research project

- The final mark of the PJR must be ≥ 10.
- For master thesis

The final mark of the master thesis must be ≥ 10.

Retake exams are organized at the beginning of the second semester.

Graduation requirements

To be 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

At the end of the SMI programme, the final average is calculated based on the ECTS distribution, and mentions are awarded (very good, good, fair, passable).

Careers of graduates and access to further studies

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

- PhD student in a field related to Mechanical Engineering, in academia or in industry (CIFRE), to become a recognized expert in an area of Mechanical Engineering
- R&D engineer/researcher in large companies or start-ups, in numerous fields (automotive, aerospace, health, etc.)