Major	Energy Engineering		
Master's program	ENGINEERING OF ENERGY CONVERSION MACHINES		
Master's Code	IMCE		
Qualification awarded	**Master's degree in Energy Engineering**		
Program director	**Michaël DELIGANT (michael.deligant@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 program*	*Specific arrangements for recognition of prior learning*
60	**ENSAM - Campus Paris & Sorbonne Université – Campus Jussieu**	**1 year (from September to September)**	**No**
Keywords	**Energy conversion, turbomachine, thermodynamic, fluid flow, thermal, aerodynamic, turbulence, hydraulic, numerical simulation, CFD**		

Admission requirements

Type	Level	Way
English proficiency	**Level B1**	**Recommended**
French proficiency	**Level B1**	**Recommended**
Previous degree	**First-year of Master's (M1) minimum, or equivalent, in Engineering**	**Certificate of achievement**

Applicants interested in the IMCE program must follow the online procedure and adhere to the schedule.

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

Overall objectives

The Engineering of Energy Conversion Machine program is aligned with careers in the aerospace, automotive, transportation, energy production and conversion, petrochemical, and agri-food industries—particularly within the Research and Development departments of these industrial companies. These sectors heavily rely on the optimized design, development, and control of rotating machinery (such as pumps, turbines, fans, compressors, volumetric machines, etc.). The program provides knowledge in both aero thermodynamic and hydrodynamic modeling, as well as mechanical modeling, durability, and performance optimization of these machines and systems. The objectives of the training are:

- Acquire expertise in the design and flow analysis of turbomachinery (pumps, fans, compressors, turbines, various volumetric machines, etc.).
- Develop skills in the fields of energy systems, aerodynamics, thermodynamics, fluid mechanics, and mechanics.

Program learning goals

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

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 IMCE program are as follows:

- A specialization closely aligned with the Research and Development challenges faced by many industries.
- R&D is approached from a broad industrial perspective.
- Students acquire knowledge in aerodynamics, hydrodynamics, thermal, and mechanical modeling, as well as in the optimization of the performance of energy conversion systems
- Knowledges in turbomachinery design, performance analysis and optimization

Program 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 industrial configurations, in order to develop multiple transversal skills.

The IMCE program is a one-year Master program that spreads on two semesters

- **First semester (S3): From September to February**
  The first semester of this program is composed of 10 courses of 24 to 30 hour each granting 3 ECTS credit each, for a total of 30 ECTS. Among the 10 courses, there are 8 scientific modules and 2 professionalizing modules: strategic management and scientific communication in a foreign language. The scientific modules gather 6 compulsory classes and 2 optional courses selected withing a list of approved modules. These choices allow the students to adapt their curriculum toward their preferred sector of applications (nuclear, renewable, building).
- **Second semester (S4): From February to September**
  The second semester is dedicated to an internship(of 4 to 6 months) and the production of a Master thesis, for a total of 30 ECTS. The internship will be carried out in a research structure (laboratory or company) in France or abroad.

Code	Title	Sem.	Year	ECTS	Hours	Compulsory/ Optional	Teaching modalities
	Research Internship (Master thesis)	S4	M2	30	5/6 months	Compulsory	Internship
UM5MEE00	Advanced thermodynamics	S3	M2	3	~30	Compulsory	Course/Conferences/Project
UM5MEE01	Turbulence modelling	S3	M2	3	~30	Compulsory	Course/Conferences/Project
UM5MEE10	Turbomachine 1: aero hydrodynamic of turbomachines	S3	M2	3	~30	Compulsory	Course/Conferences/Project
UM5MEE11	Thermo-hydraulics 1	S3	M2	3	~30	Compulsory	Course/Conferences/Project
UM5MEE25	Turbomachines 2: Performance optimization of turbomachines	S3	M2	3	~30	Compulsory	Course/Conferences/Project
UM5MEE26	Initiation to scientific research on energy efficient systems and technologies	S3	M2	3	~30	Compulsory	Course/Conferences/Project
UM5MEE27	Strategic management	S3	M2	3	~30	Compulsory	Course/Conferences/Project
UM5MEE37 or UM5MEE38	Scientific communication in a foreign language English (UM5MEE37) or French (UM5MEE38)	S3	M2	3	24	Compulsory	Course/Conferences/Project
UM5MEE16	Nuclear energy	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE14	Optimization of energy systems	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE15	Kinetic theory of gases	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE12	Experimental methods	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MET01	IA for fluid mechanics and energy	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE20	Organic Rankine cycle and turbines	S3	M2	3	~30	Optional	Course/Conferences/Project

Code	Title	Sem.	Year	ECTS	Hours	Compulsory/ Optional	Teaching modalities
UM5MEE23	Radiation and air quality	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE24	System modelling for thermal and nuclear energy	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE28	Electricity storage	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE29	Life cycle assessment	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE30	Hydrogen technologies and value chain	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE31	Eco-design for building	S3	M2	3	~30	Optional	Course/Conferences/Project
UM5MEE32	Thermo-hydraulics 2	S3	M2	3	~30	Optional	Course/Conferences/Project

Table 1: Detail of the modules of the IMCE program 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 program. Each module is evaluated between 0 and 20.

- The final mark of modules S3 must be ≥ 10, and there is compensation between the modules.
- For master thesis the final mark must be ≥ 10.

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

Graduation requirements

To graduate, 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 IMCE program, 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

After completion, graduates from this master program would be looking for job opportunities in aerospace, automotive, rail transport, shipping, energy production, petroleum, housing industries, public or private laboratories and technical centers.

Students willing to pursue their scientific training will be equipped for PhD studies and capable to work either on fundamental or applied topics of energy, fluid and thermal engineering, turbomachines and energy conversion systems.

In the current energy transition period requiring disruptive and incremental innovation, numerous opportunities are regularly available, either in public laboratories and within industry research and development teams. In particular, the Agence Nationale de la Recherche Technologique provides valuable funding for PhD student doing their thesis in close collaboration with industry.