



Major	Mechanical Engineering		
Master's programme	MECHANICS & ENERGETICS		
Master's Code	ME-INAES		
Qualification awarded	Master degree		
Programme director	Prof. Azita AHMADI-SENICHAULT (Azita.ahmadi@ensam.eu)		
Mode of study	Level of qualification	Field of study	Language of study
Full time	Master	Engineering	French (~20% in English)
ECTS	Campus	Length of programme	Specific arrangements for recognition of prior learning
60	Bordeaux	1 year (2nd year of Master – Master 2– Sept. to Sept.)	
Keywords	Mechanics, energetics, Transfer phenomena, aeronautics, space, composite materials, additive manufacturing		

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 an equivalent degree in mechanics or mechanical Engineering	Certificate of achievement

Applicants interested in the ME-INAES programme must follow the online procedure and adhere to the schedule.

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

Overall objectives

Marked by the regional dynamics around aerospace activities such as the world competitiveness cluster Aerospace Valley <http://www.aerospace-valley.com/> which is the first European employment pool in aeronautics, space and embedded systems and the presence of a large network of international equipment manufacturers (ASTRIUM Space Transportation, CEA, CNES, DASSAULT Aviation, EADS, SAFRAN, THALES, Liebherr Aerospace, Messier-Dowty, ...), the ME-INAES programme aims at training future engineers and researchers to evolve in academic and industrial environments related to aerospace applications.



Programme learning goals

The table below details the abilities to be acquired and the expected proficiency levels in accordance with the following targets:

- 1) To acquire knowledge in the major mechanical and energy engineering fields (transfer phenomena, solid mechanics, design, etc.) and their application to additive manufacturing
- 2) To understand the complexity of the aerospace industry
- 3) To develop skills in the major fields of mechanics applied to the aerospace industry:
 - propulsion systems: understand the influence of the various relevant parameters that contribute to the choice of a propulsion system, and address the technical problems encountered during its design
 - different families of aeronautical materials, processes for obtaining structural parts, & methodologies for calculating and dimensioning aeronautical structures with special focus on composite structures
 - introduction to aircraft and space systems
 - quality approach, whose major role is illustrated through concrete applications from the aero-space sector
- 4) To experience a structured research methodology to be used as a template to address a wide range of Industry 4.0 related research challenges.

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	3
	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	4
	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	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 ME-INAES programme are as follows:

- Taking place in the center of Bordeaux University Campus, the Master programme benefits from a dynamic research environment: contribution of Bordeaux University staff, support from the TREFLE, DuMAS, MPI, IMC Departments of the Institute of Engineering and Mechanics (I2M) of Bordeaux <http://i2m.u-bordeaux.fr/>;
- It benefits from the presence of an active industrial landscape namely AEROSCAPE VALLEY competitiveness cluster, and numerous enterprises (SME and large groups) which develop projects on the creation and elaboration of tomorrow’s aerospace technology and science;
- It benefits from the IRT Saint Exupéry located on the ENSAM Campus in Bordeaux since 2016 which brings together public and private partners to develop world-class research activities dedicated to the aeronautical and space industries of the future.
- The program includes conferences and invited lectures given by industrials;
- Transversal adaptation, integration, analysis, critical thinking, self-learning, communication, valorization and organizational skills gained when confronting to both academic and industrial multi-disciplinary projects;
- Some particular courses are taught in English and the first semester’s research project includes a literature survey to be reported and defended in English.

Programme structure

Learning outcomes are reached through a well-balanced training program that combines theoretical and practical learning sequences.

The ME-INAES programme (Master 2) is a one-year Master programme that spreads on two semesters: S3 and S4 of Masters (Figure 1):

- **First semester (S3)**: From September to January

This semester is composed of an English language module, a management module, 3 general scientific modules of 20h each, 3 specialized modules dedicated to aeronautics and space and a long research project of 90h, 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 for 30 ECTS. The internship will be carried out in a research structure (laboratory or company) in France or abroad on a research-oriented project.

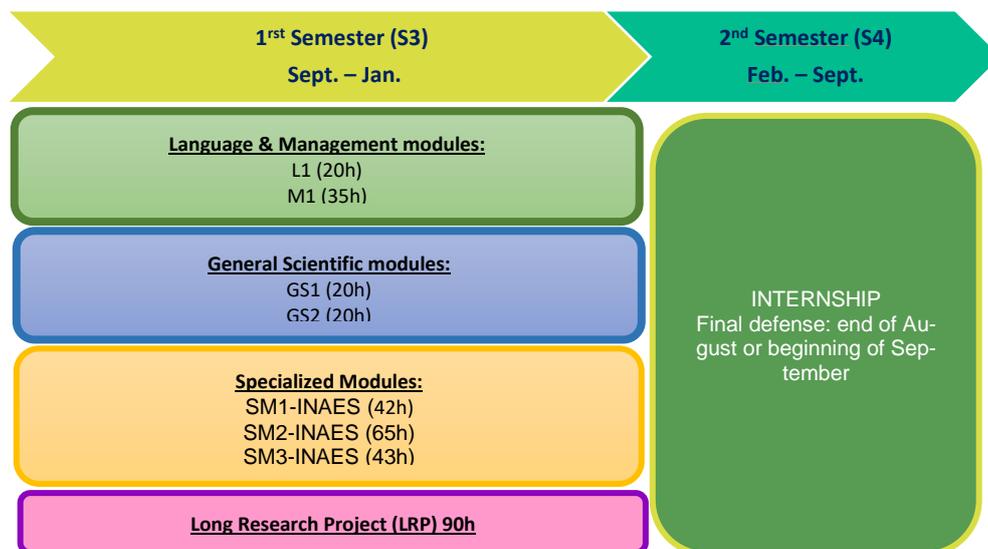


Figure 1: Structure of the ME-INAES programme.



Code	Title	Sem.	Year	ECTS	Hours	Compulsory/ Optional	Teaching modalities
L1	Engineer & the world (English)	S3	M2	2	20	Compulsory	Course/exercise/ project
M1	Management, strategy, Innovation	S3	M2	2	35	Compulsory	Course/exercise/ project
GS1	Physics of transfer phenomena	S3	M2	3	20	Compulsory	Course/exercise/ project
GS2	Solid mechanics & advanced computing	S3	M2	3	20	Compulsory	Course/exercise/ project
GS3	Additive manufacturing	S3	M2	2	20	Compulsory	Course/exercise/ project
SM1- INAES	Evolution of the design of pro- pulsion systems	S3	M2	4	43	Compulsory	Course/exercise/ project
SM2- INAES	Aeronautical materials and structures: elaboration and di- mensioning	S3	M2	5	66	Compulsory	Course/exercise/ project
SM3- INAES	Products & processes of the aer- ospace industry	S3	M2	4	42	Compulsory	Course/exercise/ project
LRP	Long research project	S3	M2	5	90	Compulsory	Long project
MT	Master Thesis	S4	M2	30	N/A	Compulsory	Internship

Table 1: Detail of the modules of the ME-INAES 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 with a mark between 0 and 20.

For each module, including the long research project and the master thesis, the final mark should be ≥ 10 . There is no compensation between modules.

Retake exams are organized at the beginning of the second semester (beginning of February).

Graduation requirements

To be graduated from **Master 2**, students need to comply with the following rules:

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

At the end of the ME-INAES programme, the final average is calculated based on the ECTS distribution. Different honors are awarded (very good, good, fair, passable) only to students who have not been obliged to participate in the retake exams.

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 aeronautics and space, in academia or in industry (CIFRE) to become a recognized expert;
- R&D engineer/researcher in large companies or start-ups, in numerous sectors (manufacturing, services, consultancy, etc.) and fields (aerospace, automotive, etc.).