Major	Mechanical Engineering		
Master's programme	ADVANCED SYSTEMS AND ROBOTICS		
Master's Code	SAR		
Qualification awarded	**Master in mechanical engineering**		
Programme director	**Prof Nazih MECHBAL Nazih.mechbal@ensam.eu Lab. PIMM – UMR CNRS, Le Cnam**		
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	**Paris**	**1 year (from September to September)**	**Yes (VAE or VAP)**
Keywords	**Robotics, Control, Modelling, Intelligent Systems**		

Admission requirements

Type	Level	Way
French proficiency	**Level B2**	**Certificate**
Previous degree	**First-year of Master's (M1) minimum, or equivalent, in Engineering**	**Approved by the admission jury**

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

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

Overall objectives

The SAR program aims to train specialists in the design of complex robotic systems and/or intelligent systems with the ability to perceive, learn, decide and act in interaction with the environment.

- The Advanced Systems and Robotics (SAR) track focuses more particularly on the aspects of modeling, simulation, and control of these systems, while integrating the multidisciplinary aspect specific to robotic systems such as the perception of the environment, autonomous systems control, artificial intelligence, and interaction with the environment.
- The objective is to prepare students for the functions of international Research & Development engineers in robotic, mechanical or mechatronic systems, interactive systems, embedded systems and intelligent systems.
- The programme focuses on two main areas: robotics and intelligent systems. It provides basic multidisciplinary knowledge in engineering sciences specific to these two fields, as well as the fundamentals for the analysis and modeling of any complex mechanical system with autonomous capabilities, or for the understanding of human interaction and learning.

Programme learning goals

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

1) To have experienced or been exposed to the current and future challenges for the technologies related to advanced and intelligent autonomous systems.
2) To be able to participate in and contribute to design and develop complex robotic and mechatronic systems.
3) To be able to understand, explain and manipulate the concepts, methods, models and tools for Robotic and mechatronic systems.
4) To be skilled in the practice or implementation of methods, models and tools i) to optimize the design of industrial robots and intelligent mechatronic systems ii) to simulate their behaviour, iii) to control and feed them with autonomous capabilities them.
5) To be able to lead or innovate in the new technologies based on mechatronic, interactive, embedded and intelligent systems.

Sets of expected 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 SAR programme are as follows:

Programme structure

- **First semester (S1): From September to January**
  This semester is composed of 3 core courses including 1 language module (15 ECTS) and 8 elective scientific courses (15 ECTS) for a total of 30 ECTS.
- **Second semester (S2): 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.

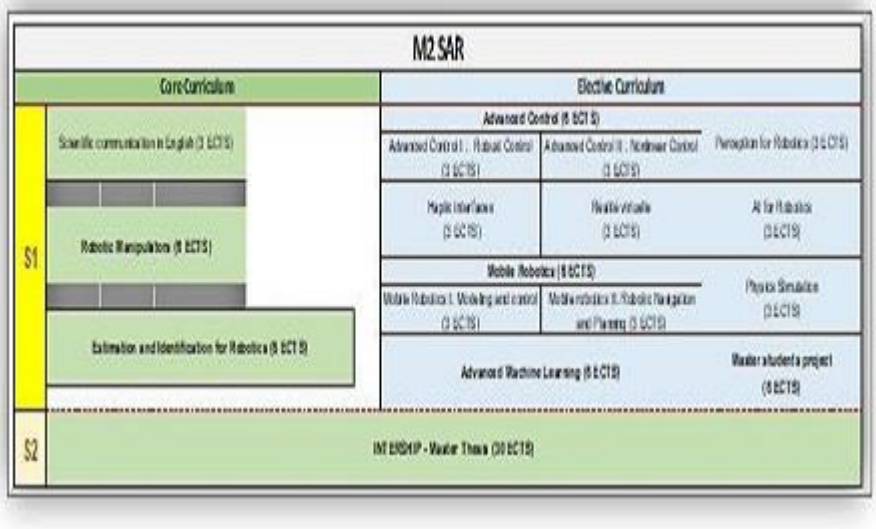

Figure 1 : Structure of the SAR programme.

Code	Title	Sem.	Year	ECTS	Hours	Compulsory/ Optional	Teaching modalities
MSA-RANG	Scientific communication English	S3	M2	3	30	Compulsory	Course/exercise/project
MU5RBR10	Robotic Manipulators	S3	M2	6	30	Compulsory	Course/exercise/project
MU5RBR20	Estimation and Identification for Robotics	S3	M2	6	30	Compulsory	Course/exercise/project
MU5RBR30	Advanced Control	S3	M2	6	60	Optional	Course/exercise/project
MU5RBR31	Advanced Control I : Robust Control	S3	M2	3	30	Optional	Course/exercise/project
MU5RBR32	Advanced Control II : Nonlinear Control	S3	M2	3	30	Optional	Course/exercise/project
MU5RBR40	Mobile Robotics	S3	M2	3	30	Optional	Course/exercise/project
MU5RBR01	Physics Simulation	S3	M2	3	30	Optional	Course/exercise/project
MU5RBR02	Perception for Robotics	S3	M2	3	30	Optional	Course/exercise/project
MU5RBR03	Haptic interfaces	S3	M2	3	30	Optional	Course/exercise/project

Code	Title	Sem.	Year	ECTS	Hours	Compulsory/ Optional	Teaching modalities
MU5RBI01	Advanced Machine Learning	S3	M2	6	60	Optional	Course/exercise/project
MU5RBI02	AI for Robotics	S3	M2	3	30	Optional	Course/exercise/project
MU5RBI10	Master students project	S3	M2	6	60	Optional	Project
MUPROJECT	Master Student Thesis	S4	M2	30	6 months	Core	Internship

Table 1 : Detail of the modules of the SAR 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.

The control of knowledge and the evaluation of acquired skills are done 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. Notes acquired in continuous review are not subject to a second session. A catch-up session is organized 15 days after the initial session jury.
- Each teaching unit (TU) is marked from 0 to 20.
- A TU is validated if the final mark is ≥ 10. The control procedures are specified by each TU manager.
- Training, projects, courses, are evaluated both on the basis of continuous monitoring and on the basis of restitution (report and / or defense).
- The first semester is validated if the average of all the compulsory and the optional TUs is ≥ 10, thus there can be compensation between the modules.
- For master thesis (6 months internship), the final mark of 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

- Semester 1: Validation of TU for 30 ECTS
- Semester 2: Validation of master thesis (individual project) for 30 ECTS

Careers of graduates and access to further studies

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

- The SAR Master will allow students to continue in all programs requiring this level of study promoting the pursuit in a PhD thesis in science.