+ Master of Science and Technology in Complex Systems Engineering – MScT CSE Biomedical engineering

+ June 2025

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Training Program 2025-2026
Approved by CE – CS – CA

Centrale Méditerranée

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1. General Overview of the Training Program

Environmental system which lies at the core of current major challenges, is a “complex system” which overall behavior is controlled by the interactions of all its multiple elements. Understanding, modeling and handling such systems require specific skills that students will acquire thanks to the Master of Science and Technology in Complex Systems Engineering (MScT CSE). It will provide you with a rich interdisciplinary educational experience in environmental engineering and prepare you for a professional career in optimal conditions.

The MscT in Complex Systems Engineering (MScT CSE) addresses the need for engineers trained at an international level, capable of understanding, modeling, designing, implementing, and managing these "complex systems." It aims to train bicultural engineers with strong scientific and technical skills, as well as solid experience in management, innovation, and research.

This 2-year program is divided into 2 parts:

- The DNM National Master’s Degree SCIENCES ET TECHNOLOGIES, mention INGENIERIE DES SYSTEMES COMPLEXES ;
- Additional modules relating to the validation of optional courses to harmonise knowledge levels and language skills, as well as training related to project management, general management and organisation.

The MScT CSE is fully taught in English and composed of three tracks:

- Environmental Engineering, focused on Water & Energy - M1 & M2
- Biomedical Engineering, focused on Biomechanics and device design, quantitative imaging, and diagnostics (detection and treatment & interpretation) - M1 & M2
- Engineers for Smart Cities, offered in joint-degree with the Université Côte d’Azur, focused on Smart City – M2

This Master's degree is centered on the strengths and assets of the Ecole Centrales' training specificities: multi-disciplinary teaching in sciences and engineering, tight links with companies, awareness of societal issues, managerial teaching,... addressed through a combination of academic teaching, workshop activities, projects, immersion and experiential learning. Close links with laboratories have been forged thanks to a rhythm promoting periods of immersion throughout the two years of the course.

Within the Environmental Engineering and Biomedical Engineering tracks, many courses are shared with the engineering program at Centrale Méditerranée.

In addition to these 120 ECTS required for the National Master's Degree “mention Ingénierie des Systèmes Complexes”, an additional 20 ECTS are accumulated during semester 7 (10 ECTS) and semester 9 (10 ECTS). These credits reward the acquisition of specific skills from the Centrale Engineer's competence framework:

- Soft skills: Understanding communication profiles, Leadership and Eloquence, Optimization of collective performance, Change management

- Mastery of complexity: The proposed "Training" activities aim to explore the means of describing and analyzing complexity in all its dimensions (dynamic systems, complex industrial project management, human factors, ...).

The validation of 140 ECTS is necessary to obtain the Institution Diploma “Master of Science and Technology in Complex Systems Engineering (MScT CSE)”, conferred by the Ecole centrale de Marseille in addition to the National Master's Degree “mention Ingénierie des Systèmes Complexes”.

2. Training program

The Master's program is composed of 4 semesters, numbered S7 to S10.

1st semester – S7: common scientific foundation
The courses offered in S7 aim to ensure a leveling up and a scientific foundation, with basic training in programming, numerical methods, transport phenomena, and thermodynamics (common core), as well as more specialized introductory courses. Indeed, since the Master's students level is inherently heterogeneous, the goal of this semester is to provide leveling up in fundamental and applied sciences. The semester concludes with a 6 to 8-week research internship in a laboratory.

2nd semester – S8: deepening
S8 offers thematic exploration of major environmental engineering issues related to water and energy, as well as key challenges and domains of bioengineering. Master's students attend the Semester 8 courses of the engineering cycle alongside the engineering students of Centrale Méditerranée. A few specific modules are also provided for Master's students. The semester concludes with a two- to three-month internship in a laboratory or company.

3rd semester – S9: deepening and professionalization
The final academic semester allows students to complete and deepen their scientific knowledge while acquiring more technical skills related to these disciplines. Many external contributors from the research and industry sectors participate in the program through courses, projects, and guest seminars.

4th semester – S10: Master's Thesis
This last semester involves a 4 to 6-month immersion in an internship, either in a company or laboratory, focused on a topic aligned with the chosen specialty. It culminates in the completion of a master's thesis and an oral defense.

3. Training Framework

NB: The teaching units marked with asterisks are partially (*) or entirely (**) shared with the engineering program.

Semester 7 Framework - Academic Year 2025-2026

S7 Framework – Common Core

Semester 7 – Common Core	Student credits	Student hours	Hour details	
			CM	TD/TP
Transport phenomena	4	32	24	8
Computer sciences and numerical methods	3	24	16	8
Industrial engineering & Soft Skills	4	32		32
Language*	2	20		20
Training in CSE*	6	62		
Lab internship	6	-		
Total	**25**	**170**		

S7 Framework - Biomedical Engineering

Semester 7 - Biomedical Engineering	Student credits	Student hours	Hour details	
			CM	TD/TP
Introduction to clinical medecine	3	24	16	8
Introduction to material sciences	3	24	16	8
Introduction to signal & image processing	3	24	16	8
Engineering & biological systems	3	24	16	8
Waves propagation	3	24	16	8
Total	**15**	**120**		

Semester 8 Framework - Academic Year 2025-2026

S8 Framework – Common Core

Semester 8 – Common Core	Student credits	Student hours	Hour details			
			CM	TD	TP	Project
Language*	2	20		20		
Internship	6	-				
Total	**8**	**20**				

S8 Framework - Biomedical Engineering

Semestre 8 - Biomedical Engineering	Crédits élève	Heures élèves	Détail horaire			
			CM	TD	TP	Projet
The living bricks**	6	58	50		8	
Imaging and wave therapy**	6	46	36		10	
Bioinformatics & data processing**	6	52	36		16	
Bio planet**	4	50	15			35
Total	**22**	**206**				

Semester 9 Framework - Academic Year 2025-2026

S9 Framework – Common Core

Semestre 9 - TC	Crédits élèves	Heures élèves	Détail horaire			
			CM	TD	TP	Projet
Computer Sciences & data sciences	3	24	18	6		
Industrial engineering & Soft Skills*	6	80				
Language*	2	20		20		
Project & Seminars	4	100				100
Total	**15**	**224**				

S9 Framework - Biomedical Engineering

Semestre 9 - Biomedical Engineering	Crédits élèves	Heures élèves	Détail horaire			
			CM	TD	TP	Projet
Elective in Advanced imaging for biomedical**	3	24	16	8		
Biomechanics**	3	24	16	8		
Modelling for BME	4	36	24		12	
Advanced material sciences & Integrated design	5	36	24	12		
Telemedicine and Medical Telemonitoring	3	24	16	8		
Introduction to Neurotechnologies	5	40	28	12		
Introduction to Bioethics	2	16	12	4		
Total	**25**	**200**				

Semester 10 Framework - Academic Year 2025-2026

Semester 10 – Common Core	Student hours	Student credits	Hour details			
			CM	TD	TP	Project
Master Thesis	-	30				
Total	**-**	**30**				