SCIENCES, TECHNOLOGIES, SANTÉ

Master of Science and Technology in Complex Systems Engineering

Présentation

The Master of Science and Technology 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 – M2This 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”.

Centrale Méditerranée

Master of Science and Technology in Complex Systems Engineering

Programme

Organisation

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.

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

	Nature	CM	TD	TP	Crédits
Semester 7 – Common Core	Menu				
Transport phenomena	UE	24h	8h		4 crédits
Industrial engineering & Soft Skills	UE		32h		4 crédits
Computer sciences and numerical methods	UE	16h	8h		3 crédits
Language*	UE		20h		2 crédits
Training in CSE*	UE				6 crédits
Lab internship	Stage				6 crédits
Semester 7 - Environmental Engineering	Menu				
Introduction to chemical engineering	UE	16h	8h		3 crédits

Introduction to environmental engineering	UE	16h	8h		3 crédits
Hydraulics and Hydrology	UE	16h	8h		3 crédits
Energy and environment	UE	16h	8h		3 crédits
Geomatics	UE	16h	8h		3 crédits
Semester 7 - Biomedical Engineering	Menu				
Introduction to clinical medecine	UE	16h	8h		3 crédits
Introduction to material sciences	UE	16h	8h		3 crédits
Introduction to signal & image processing	UE	16h	8h		3 crédits
Engineering & biological systems	UE	16h	8h		3 crédits
Waves propagation	UE	16h	8h		3 crédits

	Nature	CM	TD	TP	Crédits
Semester 8 – Common Core	Menu				
Language*	UE		20h		2 crédits
Internship	Stage				6 crédits
Semester 8 - Environmental Engineering	Menu				
Environmental management**	UE	29h	6h		3 crédits
Circular economy and sustainable design**	UE	19h	10h	10h	4 crédits
Pollutants and water waste**	UE	16h	15h		2 crédits
Green chemistry**	UE	28h	10h	8h	4 crédits
Environmental monitoring**	UE	26h	6h	8h	4 crédits
Renewable energies	UE	16h	8h		2 crédits
Project**	UE				3 crédits
Semester 8 - Biomedical Engineering	Menu				
The living bricks**	UE	50h		8h	6 crédits
Bio planet**	UE	15h			4 crédits
Elective	Menu				
Imaging and wave therapy**	UE	36h		10h	6 crédits
Bioinformatics & data processing**	UE	36h		16h	6 crédits
Biotechnologies & Therapeutic Stratégies **	UE				6 crédits

	Nature	CM	TD	TP	Crédits
Semester 9 – Common Core	Menu				
Computer Sciences & data sciences	UE	18h	6h		3 crédits
Industrial engineering & Soft Skills	UE				6 crédits
Language*	UE		20h		2 crédits
Project & Seminars	UE				4 crédits
Semester 9 - Environmental Engineering	Menu				
Energy efficiency	UE	8h	4h		2 crédits
Coastal engineering**	UE	16h	8h		3 crédits
Advanced fluid mechanics**	UE	32h	16h		4 crédits
Bioprocess	UE	16h	8h		3 crédits
Water network management	UE	8h	4h		2 crédits
Geophysical flows	UE	16h	8h		3 crédits
Water Economics	UE	16h	8h		3 crédits

Elective course from 3A**	Module	16h	8h		3 crédits
Smart cities engineering	UE	6h	6h		2 crédits
Semester 9 - Biomedical Engineering	**Menu**				
Elective	Menu				
Advanced image Processing	UE	14h		10h	3 crédits
Advanced imaging for Biomedical Applications	UE				3 crédits
Bioprocesses	UE	16h	8h		3 crédits
Biomechanics	UE	16h	8h		3 crédits
Modelling for BME	UE	24h		12h	4 crédits
Advanced material sciences & Integrated design	UE	24h	12h		5 crédits
Sensors & Medical Telemonitoring	UE	16h	8h		3 crédits
Introduction to Neurotechnologies	UE	16h		12h	3 crédits
Introduction to Bioethics	UE	12h	4h		2 crédits
Computational Neurosciences	UE				2 crédits

	Nature	**CM**	**TD**	**TP**	**Crédits**
Semester 9 – Engineers for Smart Cities	**Menu**				
Industrial engineering, Professional development & Study trip	UE		40h		7 crédits
Language & culture	UE				2 crédits
Hands-on integrated project	UE		40h		4 crédits
Smart energy & transitions	UE	44h			4 crédits
Innovation management	UE	44h			4 crédits
Smart & sustainable cities	UE	44h			4 crédits
Urban design for sustainable neighbourhoods	UE	44h			4 crédits
Smart mobility & transportation	UE	44h			4 crédits
Digital Cities	UE	44h			4 crédits

	Nature	**CM**	**TD**	**TP**	**Crédits**
Semester 10 - Master Thesis	**Menu**				
Master Thesis	Module				30 crédits