UNIVERSITÀ DEGLI STUDI DI TRIESTE

Dipartimento di Ingegneria e Architettura

"CORSO DI LAUREA MAGISTRALE INTERCLASSE" – MASTER DEGREE
MATERIALS AND CHEMICAL ENGINEERING FOR NANO, BIO, AND SUSTAINABLE TECHNOLOGIES
CLASS LM-22 R (CHEMICAL ENGINEERING) AND LM-53. (MATERIALS ENGINEERING)
PLAN OF STUDY
Academic Year 2025-2026

Students have the opportunity to pursue a personalized plan of study. There are two "curricula" with a total of **four main suggested study plans ("tracks")**:

- *Curriculum "Nanotechnology and Biotechnology"*
  - Track **"Materials Engineering for Nanotechnology and Biotechnology"**
  - Track **"Chemical Engineering for Nanotechnology and Biotechnology"**
- *Curriculum "Sustainable Industrial Technology"*
  - Track **"Materials Engineering for Sustainable Industrial Technology"**
  - Track **"Chemical Engineering for Sustainable Industrial Technology"**

Curriculum "Nanotechnology and Biotechnology"
Track: "Materials Engineering for Nanotechnology and Biotechnology"

1st year - 60 credits ("CFU")

Course	*Total CFU*	*Module*	*Disciplinary area (SSD)*	*TAF[4]*	*Module CFU*
Molecular simulation	**9**		ING-IND/24	B	9
Soft materials and release kinetics	**9**		ING-IND/24	B	9
Polymers and composites	**9**	Polymers and polymeric materials	ING-IND/22	B	6
		Composite materials	ING-IND/22	B	3
Biomateriali e Ingegneria tissutale (Italian)	**6**		ING-IND/34	C	6
Enzyme kinetics for nano and biotechnology	**6**		ING-IND/34	C	6
Molecular biology for engineering and nano-bio laboratory	**12**	Molecular biology for engineering	ING-IND/24	B	6
		Laboratory for nano-bio materials	ING-IND/24	B	6
Elective courses (*)	**9**			D	9

2nd year - 60 credits ("CFU")

Course	*Total CFU*	*Module*	*Disciplinary area (SSD)*	*TAF[4]*	*Module CFU*
Metallic materials and fracture mechanics	**6**		ING-IND/22	B	6
Materials characterization and data analysis	**9**	Data Analysis	CHIM/07	B/C**	6
		Spectroscopic methods for materials characterization	ING-IND/22	B	3
Advanced materials science	**9**	Physics of materials and radiation - matter interaction	FIS/03	B/C**	6
		Physical properties of materials	ING-IND/22	B	3
Nanomaterials for nano-bio technologies	**6**		ING-IND/24	B	6
Ceramic materials and materials characterization laboratory	**9**		ING-IND/22	B	9
Elective courses (*)	**6**			D	6
One activity between the following two:	**3**				
Italian language (mandatory if the student does not have a B2 level in Italian)				F	3
OR					
Internship				F	3
Final thesis[3]	**12**			E	12

Curriculum Nanotechnology and Biotechnology **Track: "Chemical Engineering for Nanotechnology and Biotechnology"**					
1st year - 60 credits ("CFU")					
Course	*Total CFU*	*Module*	*Disciplinary area (SSD)*	*TAF[4]*	*Module CFU*
Molecular simulation	**9**		ING-IND/24	B	9
Soft materials and release kinetics	**9**		ING-IND/24	B	9
Polymers and composites	**9**	Polymers and polymeric materials	ING-IND/22	B	6
		Composite materials	ING-IND/22	B	3
Biomateriali e Ingegneria tissutale (Italian)	**6**		ING-IND/34	C	6
Enzyme kinetics for nano and biotechnology	**6**		ING-IND/34	C	6
Molecular biology for engineering and nano-bio laboratory	**12**	Molecular biology for engineering	ING-IND/24	B	6
		Laboratory for nano-bio materials	ING-IND/24	B	6
Elective courses (*)	**9**			D	9

2nd year - 60 credits ("CFU")					
Course	*Total CFU*	*Module*	*Disciplinary area (SSD)*	*TAF[4]*	*Module CFU*
Metallic materials and fracture mechanics	**6**		ING-IND/22	B	6
Process design and control	**9**		ING-IND/24	B	9
Chemical and biochemical reaction engineering	**9**	Chemical Reaction Engineering	ING-IND/24	B	6
		Biochemical Reactors	CHIM/04	B/C**	3
Nanomaterials for Nano-Bio Technologies	**6**		ING-IND/24	B	6
Sustainable industrial chemistry	**9**		CHIM/04	B/C**	9
Elective courses (*)	**6**			D	6
Other activities between the following two:	**3**				
Italian language (mandatory if the student does not have a B2 level in Italian)				F	3
OR					
Internship				F	3
Final thesis[3]	**12**			E	12

Curriculum "Sustainable Industrial Technology" **Track: "Materials Engineering for Sustainable Industrial Technology"**					
1st year - 60 credits ("CFU")					
Course	*Total CFU*	*Module*	*Disciplinary area (SSD)*	*TAF[4]*	*Module CFU*
Molecular simulation	**9**		ING-IND/24	B	9
Soft materials and release kinetics	**9**		ING-IND/24	B	9
Polymers and composites	**9**	Polymers and polymeric materials	ING-IND/22	B	6
		Composite materials	ING-IND/22	B	3
Materials, systems and critical raw materials for the energy transition	**12**	Materials for the energy transition	ING-IND/22	B	3
		Systems for the energy transition	ING-IND/31	C	3
		Strategic and critical raw materials	CHIM/07	B/C**	3
		Substitution of critical materials	ING-IND/22	B	3
Renewable Energy Technologies	**6**		ING-IND/09	C	6
Hydrogen and fuel cells	**6**		ING-IND/08	C	6
Elective courses (*)	**9**			D	9

2nd year - 60 credits ("CFU")					
Course	*Total CFU*	*Module*	*Disciplinary area (SSD)*	*TAF[4]*	*Module CFU*
Metallic materials and fracture mechanics	**6**		ING-IND/22	B	6
Materials characterization and data analysis	**9**	Data Analysis	CHIM/07	B/C**	6
		Spectroscopic methods for materials characterization	ING-IND/22	B	3
Advanced materials science	**9**	Physics of materials and radiation - matter interaction	FIS/03	B/C**	6
		Physical properties of materials	ING-IND/22	B	3
Design for sustainability of products and processes	**6**	Design for sustainability of processes and LCA	ING-IND/24	B	3
		Sustainable materials: selection and design	ING-IND/22	B	3
Ceramic materials and materials characterization laboratory	**9**		ING-IND/22	B	9
Elective courses (*)	**6**			D	6
Other activities between the following two:	**3**				
Italian language (mandatory if the student does not have a B2 level in Italian)				F	3
OR					
Internship				F	3
Final thesis[3]	**12**			E	12

Curriculum "Sustainable Industrial Technology" **Track: "Chemical Engineering for Sustainable Industrial Technology"**					
1st year - 60 credits ("CFU")					
Course	*Total CFU*	*Module*	*Disciplinary area (SSD)*	*TAF*[4]	*Module CFU*
Molecular simulation	**9**		ING-IND/24	B	9
Soft materials and release kinetics	**9**		ING-IND/24	B	9
Polymers and composites	**9**	Polymers and polymeric materials	ING-IND/22	B	6
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Materials, systems and critical raw materials for the energy transition	**12**	Materials for the energy transition	ING-IND/22	B	3
		Systems for the energy transition	ING-IND/31	C	3
		Strategic and critical raw materials	CHIM/07	B/C**	3
		Substitution of critical materials	ING-IND/22	B	3
Renewable Energy Technologies	**6**		ING-IND/09	C	6
Hydrogen and fuel cells	**6**		ING-IND/08	C	6
Elective courses (*)	**9**			D	9

2nd year - 60 credits ("CFU")					
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Metallic materials and fracture mechanics	**6**		ING-IND/22	B	6
Process design and control	**9**		ING-IND/24	B	9
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		Biochemical Reactors	CHIM/04	B/C**	3
Design for sustainability of products and processes	**6**	Design for sustainability of processes and LCA	ING-IND/24	B	3
		Sustainable materials: selection and design	ING-IND/22	B	3
Sustainable Industrial Chemistry	**9**		CHIM/04	B/C**	9
Elective courses (*)	**6**			D	6
Other activities between the following two:	**3**				
Italian language (mandatory if the student does not have a B2 level in Italian)				F	3
OR					
Internship				F	3
Final thesis[3]	**12**			E	12

(*) In the study plan, the student must register for elective courses (TAF D). Courses listed in any of the tracks not selected by the student, as well as the ones listed in the group "Elective Courses" below require no specific approval as elective courses, i.e. students can add them directly through the online system "esse3". The student can propose other elective courses, but they are subject to approval. The student cannot enroll in an elective course if s/he has already given the same or equivalent exam in previous courses of study.

(*) ELECTIVE COURSES (automatically approved)			
Course	*Disciplinary area (SSD)*	*TAF[4]*	*CFU*
Computational fluid dynamics and heat transfer	ING-IND/10	D	9
Elementi di termofluidodinamica per le macchine - IN ITALIAN	ING-IND/06	D	9
La sicurezza ed igiene negli ambienti di lavoro - IN ITALIAN	ING-IND/35	D	6
Tecnologia meccanica - IN ITALIAN	ING-IND/16	D	6
Impianti di abbattimento delle emissioni - IN ITALIAN	ING-IND/17	D	6
Modellazione solida - IN ITALIAN	ING-IND/15	D	3
Progettazione meccanica con materiali avanzati e additive manufacturing - IN ITALIAN	ING-IND/14	D	6
Proprietà e applicazioni dei materiali con laboratorio - IN ITALIAN	ING-IND/22	D	9
Metallurgia e corrosione con laboratorio - IN ITALIAN	ING-IND/22	D	9
Meccanica applicata alle macchine - IN ITALIAN	ING-IND/13	D	6
Termodinamica - IN ITALIAN	ING-IND/24	D	9
Ingegneria dei processi di separazione - IN ITALIAN	ING-IND/24	D	9
Fenomeni di trasporto - IN ITALIAN	ING-IND/24	D	9
Scienza delle costruzioni - IN ITALIAN	ICAR/08	D	9
Fondamenti di fisica delle superfici - IN ITALIAN	FIS/03	D	6
Energie rinnovabili – IN ITALIAN	CHIM/04	D	6

EVALUATION

The level of knowledge will be evaluated by oral and/or written exams, as detailed by each instructor in the syllabus and at the beginning of the course.

IMPORTANT NOTES FOR THE STUDENT

1. The master degree ("Laurea magistrale") in Materials and Chemical Engineering for Nano, Bio, and Sustainable Technologies is an **interclass degree** ("corso di Laurea interclasse"), i.e. it can be conferred in one of two different "degree classes" of the Italian system ("classi di laurea"): either Chemical Engineering (LM-22), or Materials Engineering (LM-53). **The student is required to choose the degree class before the beginning of the second year.**
2. Additional personalization beyond the proposed plans of study can be possible; in this case, students are required to consult with the coordinator in order to design a plan of study in line with the degree class selected and with the student's inclination.
3. The "Final Thesis" consists of an original and independent work in the field of materials engineering and/or chemical engineering. It can take the form of an extensive analysis of the scientific literature on a current relevant topic, or a design project, or a research project based on experiments, theory, or computational simulation. The work can be carried out entirely at the University of Trieste and/or in collaboration with other universities, research centers, and industries – both domestic and international.
4. Courses are classified according to the "Type of Educational Activity" ("TAF"):

   TAF B = characterizing courses
   TAF C = complementary courses
   TAF D = elective courses
   TAF E = final thesis
   TAF F = other educational activities

   (**) Courses marked as "TAF B/C" are "characterizing" for one class and "complementary" for the other.