

Study Plan Master's Degree Program MECHATRONICS AND SMART TECHNOLOGY ENGINEERING (a.y. 2023-2024)

Curriculum: **MECHATRONICS**

Curriculum: **SMART TECHNOLOGY ENGINEERING**

FIRST YEAR

Number		Course	Code	Credits	Area	Taught	Period	Professor
1	X	Sustainable Energy	161003-M1	9	ING-IND/09	ENG	1	Silvia Ravelli
2,1	X	C.I. Virtual and Physical Prototyping + Advanced Machine Design (module VPP)	161001	6	ING-IND/15	ENG	1	Daniele Regazzoni Daniele Landi
3	X	Fondamenti di automatica	39028	9	ING-INF/04	ITA	1	Fabio Previdi
	*	C.I. Automazione industriale (6 CFU) + Laboratory Sustainable Industrial Systems SIS (3 CFU)	161012	9	ING-INF/04	ITA-ENG	1+2	da definire Mirko Mazzoleni
	#	C.I. Control system technology (6 CFU) + Laboratory Sustainable Industrial Systems SIS (3 CFU)	161015	9	ING-INF/04	ENG	2	da definire Mirko Mazzoleni
4,1	X	C.I. Progettazione funzionale di sistemi meccanici e meccatronici (modulo Progettazione funzionale dei sistemi meccanici)	39072-ENG	6	ING-IND/13	ITA	1	Paolo Righettini
4,2	X	C.I. Progettazione funzionale di sistemi meccanici e meccatronici (module Functional design of mechatronic systems)	39072-ENG	3	ING-IND/13	ENG	2	Paolo Righettini
	#	C.I. IT architecture in production + Functional design of mechatronic systems	161016	9	ING-IND/13	ENG	2	Oliver Riedel Paolo Righettini
5	X	Power drive systems for mechanical machinery and vehicles	161017	6	ING-IND/13	ITA	2	Bruno Zappa
6	X	Elettronica e misure industriali	39027	9	ING-INF/01	ITA	2	Valerio Re
	#	Smart sensors and electronic systems	39168-ENG	9	ING-INF/01	ENG	1	Valerio Re Gianluca Traversi
2,2	X	C.I. Virtual and Physical Prototyping + Advanced Machine Design (modulo AMD)	161001	6	ING-IND/14	ENG	2	Sergio Baragetti
7	X	Mechanical vibrations	39074-ENG	6	ING-IND/13	ENG	2	Paolo Righettini

(*) : Only for students who have taken the main course in the Bachelor's degree program

(#) : Only for international students and students who have taken the main course in the Bachelor's degree program

FIRST YEAR

Number		Course	Code	Credits	Area	Taught	Period	Professor
1,1	X	C.I. Sustainable Energy + Thermal Physics for advanced technology (module SE)	161003	9	ING-IND/09	ENG	1	Silvia Ravelli
1,2	X	C.I. Sustainable Energy + Thermal Physics for advanced technology (module TP)	161003	6	ING-IND/10	ENG	1	Simona Tonini
2,1	X	C.I. Virtual and Physical Prototyping + Advanced Machine Design (module VPP)	161001	6	ING-IND/15	ENG	1	Daniele Regazzoni Daniele Landi
3	X	Smart sensors and electronic systems	39168-ENG	9	ING-INF/01	ENG	1	Valerio Re Gianluca Traversi
2,2	X	C.I. Virtual and Physical Prototyping + Advanced Machine Design (modulo AMD)	161001	6	ING-IND/14	ENG	2	Sergio Baragetti
4	X	Industrial plant design and simulation	161005	6	ING-IND/17	ENG	2	Chiara Cimini
5	X	Materials for advanced engineering applications	39171-ENG	6	ING-IND/22	ENG	2	Sergio Lorenzi
6	X	Data science and automation	39170-ENG	6	ING-INF/04	ENG	2	Davide Previtali
7	X	Mechanical vibrations	39074-ENG	6	ING-IND/13	ENG	2	Paolo Righettini

SECOND YEAR

Number		Course	Code	Credits	Area	Taught	Period	Professor
8	X	Advanced manufacturing technologies	161007	6	ING-IND/16	ENG	1	Gianluca D'Urso
9-10		Trasmissione del calore	39021	6+6	ING-IND/10	ITA	1	Gianpietro Cossali
		Meccanica dei robot	39051		ING-IND/13	ITA	1	Bruno Zappa
		IT architecture in production	39187-ENG		ING-IND/13	ENG	2	Oliver Riedel
		Sistemi meccatronici	39053		ING-IND/13	ITA	1	Paolo Righettini
		Progettazione FEM	39056		ING-IND/14	ITA	2	Sergio Baragetti
		Innovazione di prodotto e di processo (6 CFU)	39218		ING-IND/15	ITA	1	Davide Russo
		Industrial plant design and simulation	161005		ING-IND/17	ENG	2	Chiara Cimini
		Electric energy conversion and management	161014		ING-IND/32	ENG	2	Paolo Giangrande
		Sensori	38058		ING-INF/01	ITA	1	Gianluca Traversi
		Controlli automatici	39067		ING-INF/04	ITA	1	Fabio Previdi
	Robotica	39068	ING-INF/05	ITA	1	Davide Brugali		
11		LAB Mechatronic systems (17 CFU)		17			2	

SECOND YEAR

Number		Course	Code	Credits	Area	Taught	Period	Professor
8	X	Advanced manufacturing technologies	161007	6	ING-IND/16	ENG	1	Gianluca D'Urso
9-10		Combustione e impatto ambientale	39209-1	6+6	ING-IND/08	ITA	1	Nicoletta Franchina
		Progettazione di impianti termotecnici	39096		ING-IND/10	ITA	2	Enzo Bomardieri
		IT architecture in production	39187-ENG		ING-IND/13	ENG	2	Oliver Riedel
		Progettazione FEM	39056		ING-IND/14	ITA	2	Sergio Baragetti
		Innovazione di prodotto e di processo (6 CFU)	39218		ING-IND/15	ITA	1	Davide Russo
		Quality management systems	22027-ENG		ING-IND/16	ENG	1	Pellegrini Giuseppe
		Lean manufacturing	39122		ING-IND/17	ENG	2	Paolo Gaiardelli
		Electric energy conversion and management	161014		ING-IND/32	ENG	2	Paolo Giangrande
		Elettronica industriale	21031		ING-INF/01	ITA	1	Massimo Manghisoni
		Automazione industriale	21052-1		ING-INF/04	ITA	2	da definire
	Embedded and real time systems	21038-ENG	ING-INF/05	ENG	1	Davide Brugali		
11		LAB Smart living technologies (17 CFU)		17			2	

		LAB Smart manufacturing (17 CFU)				2	
12		Elective course (6 CFU)		12			
		Elective course (6 CFU)					
	X	Computer and telematic skills (*)	39077	1			
	X	Thesis work and final defense	161000	12			

(*) included in thesis preparation

		LAB Smart manufacturing (17 CFU)				2	
12		Elective course (6 CFU)		12			
		Elective course (6 CFU)					
	X	Computer and telematic skills (*)	39077	1			
	X	Thesis work and final defense	161000	12			

(*) included in thesis preparation

Curriculum: **MECHATRONICS**

Course	Code	Credits	Area	Taught	Period	Professor
LAB Mechatronic systems						
Advanced mechatronics design	161008-1	4	ING-IND/13	ENG	2	Filippo Cortinovis
Machine and structural design	161008-2	3	ING-IND/14	ENG	2	Mario Lavella
Industrial IOT	161008-3	3	ING-INF/01	ENG	2	Gianluca Traversi
Mechanical system control	161008-4	4	ING-INF/04	ENG	2	Nicholas Valceschini
Embedded system software design	161008-5	3	ING-INF/05	ENG	2	Davide Brugali

Course	Code	Credits	Area	Taught	Period	Professor
LAB Smart manufacturing						
Robots and automatic machinery for industrial applications	161010-1	4	ING-IND/13	ENG	2	Paolo Righettini
Human-machine interaction	161010-2	3	ING-IND/15	ENG	2	Daniele Regazzoni Christian Spreafico
Smart manufacturing technologies	161010-3	3	ING-IND/16	ENG	2	Chiara Ravasio
Advanced production systems	161010-4	4	ING-IND/17	ENG	2	Chiara Cimini Paolo Gaiardelli
Collaborative robotics	161010-5	3	ING-INF/04	ENG	2	da definire

Each student must select:

- **2 courses** in position #9-10
- **1 multidisciplinary LAB** in position #11
- **2 elective courses** in position #12

Curriculum: **SMART TECHNOLOGY ENGINEERING**

Course	Code	Credits	Area	Taught	Period	Professor
LAB Smart living technologies						
Structural monitoring	161009-1	3	ICAR/08	ENG	2	Rosalba Ferrari
Structural safety and risk assessment	161009-2	3	ICAR/09	ENG	2	Andrea Belleri
Energy systems design	161009-3	4	ING-IND/09	ENG	2	Giuseppe Franchini Giovanni Brumana
Smart grids	161009-4	4	ING-IND/33	ENG	2	Mariacristina Roscia
Sensors	161009-5	3	ING-INF/01	ENG	2	Gianluca Traversi

Course	Code	Credits	Area	Taught	Period	Professor
LAB Smart manufacturing						
Robots and automatic machinery for industrial applications	161010-1	4	ING-IND/13	ENG	2	Paolo Righettini
Human-machine interaction	161010-2	3	ING-IND/15	ENG	2	Daniele Regazzoni Christian Spreafico
Smart manufacturing technologies	161010-3	3	ING-IND/16	ENG	2	Chiara Ravasio
Advanced production systems	161010-4	4	ING-IND/17	ENG	2	Chiara Cimini Paolo Gaiardelli
Collaborative robotics	161010-5	3	ING-INF/04	ENG	2	da definire

Each student must select:

- **2 courses** in position #9-10
- **1 multidisciplinary LAB** in position #11
- **2 elective courses** in position #12

Curriculum: **MECHATRONICS****Elective courses**

Course	Code	Credits	SSD	Taught	Semester	Professor
Computational mechanics of solids and structures	60039-ENG	6	ICAR/08	ENG	1	Rosalba Ferrari
Computational fluid dynamics	39070-ENG	6	ING-IND/06	ENG	1	Alessandro Colombo
Combustione e impatto ambientale	39209-1	6	ING-IND/08	ITA	1	Nicoletta Franchina
Internal combustion engines and vehicle aerodynamics	39046-ENG	6	ING-IND/08	ENG	2	Nicoletta Franchina Alessandro Colombo
Experimental techniques for fluid machinery	39204	6	ING-IND/08 (3) ING-IND/12 (3)	ENG	2	Giovanna Barigozzi
Tecnologie delle energie rinnovabili	39071	6	ING-IND/09	ITA	2	Giuseppe Franchini
Acustica applicata	60118	6	ING-IND/10	ITA	2	Maurizio Santini
Progettazione di impianti termotecnici	39096	6	ING-IND/10	ITA	2	Enzo Bomardieri
Termofluidodinamica	39020	6	ING-IND/10	ITA	1	Gianpietro Cossali Lorenzo Botti
Trasmissione del calore	39021	6	ING-IND/10	ITA	1	Gianpietro Cossali
Misure dimensionali e collaudi di produzione	39015	6	ING-IND/12	ITA	2	Roberto Frizza
IT architecture in production	39187-ENG	6	ING-IND/13	ENG	2	Oliver Riedel
Meccanica dei robot	39051	6	ING-IND/13	ITA	1	Bruno Zappa
Modellistica e simulazione dei sistemi meccanici	39052	6	ING-IND/13	ITA	1	Vittorio Lorenzi
Sistemi meccatronici	39053	6	ING-IND/13	ITA	1	Paolo Righettini
Progettazione FEM	39056	6	ING-IND/14	ITA	2	Sergio Baragetti
Progetto di macchine	39055	6	ING-IND/14	ITA	2	Emanuele Vincenzo Arcieri
Innovazione di prodotto e di processo (6 CFU)	39218	6	ING-IND/15	ITA	1	Davide Russo
Metodi e strumenti per il ciclo di vita del prodotto	37008	6	ING-IND/15	ITA	2	Caterina Rizzi
Quality management systems	22027-ENG	6	ING-IND/16	ENG	1	Pellegrini Giuseppe
Studi di fabbricazione	39057	6	ING-IND/16	ITA	2	Chiara Ravasio
Tecnologie di formatura (fonderia)	39106	6	ING-IND/16	ITA	1	Giancarlo Maccarini
Tecnologie di formatura (plasticità)	39105	6	ING-IND/16	ITA	1	Giancarlo Maccarini
Gestione della produzione industriale	21033	6	ING-IND/17	ITA	2	Fabiana Pirola
Industrial plant design and simulation	161005	6	ING-IND/17	ENG	2	Chiara Cimini
Lean manufacturing	39122	6	ING-IND/17	ENG	2	Paolo Gaiardelli
Corrosione e protezione dei materiali (6 CFU)	39010	6	ING-IND/22	ITA	1	Tommaso Pastore
Materiali polimerici, compositi e ceramici	39013	6	ING-IND/22	ITA	1	Marina Cabrini
Materials for advanced engineering applications	39171-ENG	6	ING-IND/22	ENG	2	Sergio Lorenzi
Science and technology of light alloys	39109-ENG	6	ING-IND/22	ENG	2	Sergio Lorenzi
Electric energy conversion and management		6	ING-IND/32	ENG		Paolo Giangrande
Gestione aziendale e dei sistemi logistici	39076	6	ING-IND/35	ITA	2	Albachiara Boffelli
Elettronica industriale	21031	6	ING-INF/01	ITA	1	Massimo Manghisoni
Sensori	38058	6	ING-INF/01	ITA	1	Gianluca Traversi
Automazione industriale	21052-1	6	ING-INF/04	ITA	2	da definire
Controlli automatici	39067	6	ING-INF/04	ITA	1	Fabio Previdi
Data science and automation	39170-ENG	6	ING-INF/04	ENG	2	Davide Previtati
Embedded and real time systems	21038-ENG	6	ING-INF/05	ENG	1	Davide Brugali
Intelligenza artificiale	38089-MOD1	6	ING-INF/05	ITA	2	Domenico Fabio Savo
Robotica	39068	6	ING-INF/05	ITA	1	Davide Brugali
Calcolo numerico	39064	6	MAT/08	ITA	1	Francesca Maggioni
Statistics for digital and organisational innovation	37195-E2	6	SECS-S/02	ENG	2	Alessandro Fassò

The selection of other courses provided by the School of Engineering must be verified and approved by the Degree Program Board

A **curricular internship** or a **Summer / Winter School** or a **CREO-Lab** (max 6 credits) can be included among the 12 credits for elective courses after evaluation by the Degree Program Board

Additional elective activities (supernumerary credits)

Course	Code	Credits	SSD	Taught	Semester	Professor
Etica e diritto per le professioni ingegneristiche	37211	6	IUS/20 IUS/06	ITA	2	Corrado Del Bo Barbara Pezzini
CREO-Lab Tourism and creative industries	44167-ENG	6		ENG	2	Federica Burini
CREO-Lab Salute	16021	6		ITA	2	Mara Bergamaschi
CREO-Lab Sustainability	179010-ENG	6		ENG	2	Silvana Signori
CREO-Lab Tecnologie digitali e intelligenza artificiale	38110	6		ITA	2	Antonio Ferramosca

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Curriculum: **SMART TECHNOLOGY ENGINEERING****Elective courses (taught in English)**

Course	Code	Credits	SSD	Taught	Semester	Professor
Computational mechanics of solids and structures	60039-ENG	6	ICAR/08	ENG	1	Rosalba Ferrari
Computational fluid dynamics	39070-ENG	6	ING-IND/06	ENG	1	Alessandro Colombo
Internal combustion engines and vehicle aerodynamics	39046-ENG	6	ING-IND/08	ENG	2	Nicoletta Franchina Alessandro Colombo
Experimental techniques for fluid machinery	39204	6	ING-IND/08 (3) ING-IND/12 (3)	ENG	2	Giovanna Barigozzi
IT architecture in production	39187-ENG	6	ING-IND/13	ENG	2	Oliver Riedel
Quality management systems	22027-ENG	6	ING-IND/16	ENG	1	Pellegrini Giuseppe
Lean manufacturing	39122	6	ING-IND/17	ENG	2	Paolo Gaiardelli
Science and technology of light alloys	39109-ENG	6	ING-IND/22	ENG	2	Sergio Lorenzi
Electric energy conversion and management	161014	6	ING-IND/32	ENG	2	Paolo Giangrande
Embedded and real time systems	21038-ENG	6	ING-INF/05	ENG	1	Davide Brugali
Statistics for digital and organisational innovation	37195-E2	6	SECS-S/02	ENG	2	Alessandro Fassò

Other elective courses (taught in Italian)

Course	Code	Credits	SSD	Taught	Semester	Professor
Complementi di scienza delle costruzioni	60077-2	6	ICAR/08	ITA	1	Egidio Rizzi
Combustione e impatto ambientale	39209-1	6	ING-IND/08	ITA	1	Nicoletta Franchina
Tecnologie delle energie rinnovabili	39071	6	ING-IND/09	ITA	2	Giuseppe Franchini
Acustica applicata	60118	6	ING-IND/10	ITA	2	Maurizio Santini
Progettazione di impianti termotecnici	39096	6	ING-IND/10	ITA	2	Enzo Bomardieri
Termofluidodinamica	39020	6	ING-IND/10	ITA	1	Gianpietro Cossali Lorenzo Botti
Misure dimensionali e collaudi di produzione	39015	6	ING-IND/12	ITA	2	Roberto Frizza
Power drive systems for mechanical machinery and vehicles	161017	6	ING-IND/13	ITA	2	Bruno Zappa
Meccanica dei robot	39051	6	ING-IND/13	ITA	1	Bruno Zappa
Modellistica e simulazione dei sistemi meccanici	39052	6	ING-IND/13	ITA	1	Vittorio Lorenzi
Progettazione funzionale di sistemi meccanici	39073	6	ING-IND/13	ITA	1	Paolo Righettini
Sistemi meccatronici	39053	6	ING-IND/13	ITA	1	Paolo Righettini
Progettazione FEM	39056	6	ING-IND/14	ITA	2	Sergio Baragetti
Progetto di macchine	39055	6	ING-IND/14	ITA	2	Emanuele Vincenzo Arcieri
Innovazione di prodotto e di processo (6 CFU)	39218	6	ING-IND/15	ITA	1	Davide Russo
Metodi e strumenti per il ciclo di vita del prodotto	37008	6	ING-IND/15	ITA	2	Caterina Rizzi
Studi di fabbricazione	39057	6	ING-IND/16	ITA	2	Chiara Ravasio
Tecnologie di formatura (fonderia)	39106	6	ING-IND/16	ITA	1	Giancarlo Maccarini
Tecnologie di formatura (plasticità)	39105	6	ING-IND/16	ITA	1	Giancarlo Maccarini
Gestione della produzione industriale	21033	6	ING-IND/17	ITA	2	Fabiana Pirola
Corrosione e protezione dei materiali (6 CFU)	39010	6	ING-IND/22	ITA	1	Tommaso Pastore
Materiali polimerici, compositi e ceramici	39013	6	ING-IND/22	ITA	1	Marina Cabrini
Gestione aziendale e dei sistemi logistici	39076	6	ING-IND/35	ITA	2	Albachiara Boffelli
Elettronica industriale	21031	6	ING-INF/01	ITA	1	Massimo Manghisoni
Automazione industriale	21052-1	6	ING-INF/04	ITA	2	da definire
Controlli automatici	39067	6	ING-INF/04	ITA	1	Fabio Previdi
Intelligenza artificiale	38089-MOD1	6	ING-INF/05	ITA	2	Domenico Fabio Savo
Robotica	39068	6	ING-INF/05	ITA	1	Davide Brugali
Calcolo numerico	39064	6	MAT/08	ITA	1	Francesca Maggioni

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Additional elective activities (supernumerary credits)

Course	Code	Credits	SSD	Taught	Semester	Professor
Etica e diritto per le professioni ingegneristiche	37211	6	IUS/20 IUS/06	ITA	2	Corrado Del Bo Barbara Pezzini
CREO-Lab Tourism and creative industries	44167-ENG	6		ENG	2	Federica Burini
CREO-Lab Salute	16021	6		ITA	2	Mara Bergamaschi
CREO-Lab Sustainability	179010-ENG	6		ENG	2	Silvana Signori
CREO-Lab Tecnologie digitali e intelligenza artificiale	38110	6		ITA	2	Antonio Ferramosca

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