



UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II
SCUOLA POLITECNICA E DELLE SCIENZE DI BASE

DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

STUDY GUIDE

**CORSO DI LAUREA MAGISTRALE IN
AUTONOMOUS VEHICLE ENGINEERING (MOVE)**

Classe delle Lauree Magistrali in Ingegneria Meccanica LM-33

ACADEMIC YEAR 2023/2024

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Study course goals and employment opportunities

Vehicles for surface, air and marine transport are nowadays living a phase of deep transformation by including functionalities for greater autonomy. These functionalities range from simple forms of enhanced control of a single vehicle to the complete execution of a mission, eventually in coordination with others, without any intervention by human pilot.

The Master of Science (MS) in Autonomous Vehicle Engineering (MOVE) aims to train engineers with intercultural skills, who master themes such as:

- Design and management of autonomous land, air, and sea transport systems.
- Fusion of information to make decisions in real time.
- Sensors and algorithms for driving, navigation, and control with high autonomy level.
- Integration of the autonomous vehicle in complex environments.

Teaching is provided in English and a B2 certification is required for enrolment.

The MS MOVE is a highly interdisciplinary study course aimed to prepare engineers able to operate in the autonomous vehicle world mastering information technology subjects, such as: control, machine learning, big data, data analytics, computer vision, internet of things, integrated transport, smart road as well as their applications to vehicles. To this end an adequate knowledge of vehicles design and operation is also needed. The profile of the engineer will therefore be that of an integrator of systems and technologies, able to operate in two fields of engineering: one more mechanical, namely transportation system dynamics and control, and the other more information technology oriented, in the sense of hardware and software requirement definition and integration for autonomous guidance and navigation.

The MS MOVE includes three more characterized study plans:

- Self-driving cars.
- Autonomous aerial systems.
- Autonomous marine vehicles.

For each of them a design course is offered allowing the acquired skills to be integrated. The students will operate in industry-like groups, interacting on the different parts of the autonomous vehicle design, also with a view to enhancing team working and soft skills skill.

The MS MOVE offers extensive experimental activities in the various engineering laboratories of the University and many industry stage opportunities.

Job opportunities

Fast-track employment for MOVE graduates is towards large, medium, and small industries as well as research laboratories and spin offs operating in autonomous vehicle engineering. Furthermore, thanks to the interdisciplinary profile of MS MOVE, graduates will have further job opportunities as they exceed a frequent limit of other master's degree courses i.e. the limit to perform engineering design with strong competences focused on a specific field. In the 4.0 industry world the capability to integrate different disciplines with an intercultural approach and the capability to master application of information and communication technologies to manufacturing and operation of mechanical systems represent an increasingly indispensable requirement.

Minimum curricular requirements to enrol in MS MOVE

For enrolment in the MS MOVE the possession of one of the following two qualifications is required:

1. Three-years degree in industrial engineering (Italian L-9 class) or information engineering (Italian L-8 class). It must be guaranteed in the bachelor course the passing of a minimum of 12 CFU in SSD ING-IND/08 - Fluid Machines, ING-IND/09 - Energy and Environment Systems, ING-IND/10 - Applied Physics, ING-IND/12 - Mechanical and Thermal Measurements, ING- IND/13 - Mechanical engineering applied to machinery, ING-IND/14 - Mechanical design and machine construction, ING-IND/15 - Design and methods of industrial engineering, ING-IND/16 - Technologies and manufacturing systems, ING- IND/17 - Industrial mechanical plants.
2. Three-years degree in other scientific or technological degree classes in Italy (L-7 Civil and environmental engineering, L-30 Physical sciences and technologies, L-31 Information sciences and technologies, L-35 Mathematical sciences) or qualification obtained at abroad (for example BS or BEng) in the scientific or technological field as long as it is recognized suitable by the Didactic Committee. The passing of a minimum number of 36 CFU (ECTS) in the following scientific disciplines must be guaranteed: INF/01 - Computer Science, ING-INF/05 - Information processing systems, MAT/03 - Geometry, MAT/05 - Calculus, FIS/01 - Experimental physics. Furthermore it must be guaranteed in the bachelor course the passing of a minimum of 12 CFU in SSD ING-IND/08 - Fluid Machines, ING-IND/09 - Energy and Environment Systems, ING-IND/10 - Applied Physics, ING-IND/12 - Mechanical and Thermal Measurements, ING- IND/13 - Mechanical engineering applied to machinery, ING-IND/14 - Mechanical design and machine construction, ING-IND/15 - Design and methods of industrial engineering, ING-IND/16 - Technologies and manufacturing systems, ING- IND/17 - Industrial mechanical plants.

Knowledge of English is required for access, at least at a level comparable to B2 of the European Framework of Reference for Languages with certification issued by the University or by an accredited body.

The Didactic Committee also disciplines, according to guidelines established uniformly for all the Master's Degree Programmes in Engineering of the Polytechnic and Basic Sciences School, the methods for verifying the adequacy of the student's personal preparation.

- With reference to the qualifications referred to the above case 1, students fulfil personal preparation check when the average grade is not less than 24/30. Requests for admission to the MS MOVE by students failing the above criterion for automatic admission will be examined by the Didactic Coordination Commission which will assess the admissibility of the request with unquestionable judgment, establishing any requirements by to be fulfilled by the interested student for the admission to the Master of Science program. As an example the Commission will examine the curriculum followed by the interested student, possibly taking into consideration the marks of profit achieved in characterizing courses or in courses considered in any case of particular relevance for the successful conduct of the Master's degree program, or will prepare assessment methods (interviews, test) to verify the adequacy of the student's personal preparation, or will adopt mode C (see below) provided for the curricular additions in the above case 2.

- With reference to the qualifications referred to in the above case 2, the Didactic Coordination Commission evaluates the curricular requisites possessed by the candidate and may request from the candidate a curricular supplement to be selected, due to the extent and nature of the required additions, from the following options:
 - A. Curricular additions to be made prior to enrolment, pursuant to art. 6 paragraph 1 of the Ministerial Decree March 16, 2007, by enrolling in individual courses activated at the University and passing the related exams, pursuant to art. 16 paragraph 6 of the University Didactic Regulations (see: <http://www.unina.it/-/5601348-registration-ai-corsi-singoli>).
 - B. Enrolment in a Degree Course which automatically enters the LM MOVE course with an abbreviation of the study course and an assignment of a Study Plan which provides for the curricular additions required for enrolment in the Master of Science Program.
 - C. Enrolment in the Master's Degree course with assignment of a Study Plan which provides for alignment paths, in accordance with art. 6 paragraph 3 of the Ministerial Decree March 16, 2007, without additional credits.

Study Plan - Academic Year 2023-24

Course	Module	Year	Semester	ECTS	SSD	Category (*)	Subject Area	Prerequisites
Control Oriented Models for Vehicles Dynamics		1	1	6	ING-IND/13	2	Distinctive Training Activity	
Digital Modelling of Interactive Systems and Interfaces		1	1	6	ING-IND/15	2	Distinctive Training Activity	
Sensor Data Fusion and Measurement Uncertainty Management	Smart Sensors and Measurement Uncertainty	1	1	6	ING-IND/12	2	Distinctive Training Activity	
	Sensor Data Fusion	1	2	6				
Guidance and Navigation		1	1	6	ING-IND/05	4	Distinctive Training Activity	
Control Architectures for Autonomous Driving	Control Systems for Autonomous Ground Vehicles	1	1	6	ING-INF/04	2	Distinctive Training Activity	
	Mobile Robots	1	2	6				
Machine Learning and Big Data		1	2	9	ING-INF/05	2	Distinctive Training Activity	
Image and Video Processing for Autonomous Driving		1	2	6	ING-INF/03	2	Distinctive Training Activity	
Laboratory of Autonomous Vehicle Design and Development	Autonomous Vehicle Simulation and Experimental Testing	2	1	6	ING-IND/13	2	Distinctive Training Activity	
	Concept design of new vehicles	2	2	6	ING-IND/15	2	Distinctive Training Activity	
Elective courses (see tables below)		2		15		2 or 4	Distinctive Training Activity or "Affine or Integrative"	
Elective course (see tables below)		2		9		3	Training activities - student's own choice	
Internship		2		12		6	Further Training Activities	
Master Thesis		2		15		5	Final Test	

(*) Legend of category for training activities within DM270/04.

Training Activity	1	2	3	4	5	6	7
ref. DM270/04	Art. 10 subsection 1, a)	Art. 10 subsection 1, b)	Art. 10 subsection 5, a)	Art. 10 subsection 5, b)	Art. 10 subsection 5, c)	Art. 10 subsection 5, d)	Art. 10 subsection 5, e)

Self-Driving Cars Curriculum

Course	Module	Year	Semester	ECTS	SSD	Category (*)	Subject Area	Prerequisites
Power and Propulsion Systems for UV		2		9	ING-IND/08	2	Distinctive Training Activity	
Smart Roads and Cooperative Driving		2		6	ICAR/05	4	Affine or Integrative	
Suggested Elective Course								
Testing and validation of automated road vehicles		2		9	ICAR/05	3	Training activities - student's own choice	

Unmanned Aerial Systems Curriculum

Course	Module	Year	Semester	ECTS	SSD	Category (*)	Subject Area	Prerequisites
Systems for autonomous aircraft		2	1	6	ING-IND/05	4	Affine or Integrative	
Design of autonomous aircraft		2	2	9	ING-IND/05	4	Affine or Integrative	
Elective Course								
		2		9		3	Training activities - student's own choice	

Unmanned Marine Vehicles Curriculum

Course	Module	Year	Semester	ECTS	SSD	Category (*)	Subject Area	Prerequisites
Unmanned Marine Plants		2	1	6	ING-IND/02	4	Affine or Integrative	
Design of Autonomous Marine Vehicles		2	2	9	ING-IND/01	4	Affine or Integrative	
Elective Course								
		2		9		3	Training activities - student's own choice	

Additional Study Plan Information - Customizing the Study Plan

The MS MOVE offers three different curricula addressing Self-Driving Cars, Unmanned Aerial Systems, and Unmanned Marine Vehicles, respectively. Students have the possibility to personalize their curriculum by selecting elective courses.

Suggested Courses for student autonomous choice

Course	Programme of origin	Semester	ECTS	SSD
Applied Mechanics for Energy Efficiency	LM Mechanical Engineering for Design and Manufacturing	2	9	ING-IND/13
Bio Inspired Generative Design for Additive Manufacturing	LM Mechanical Engineering for Design and Manufacturing	2	9	ING-IND/15
Design of Mechatronic Systems	LM Mechanical Engineering for Design and Manufacturing	1	9	ING-IND/14
Mathematical Physics Models	LM Mathematical Engineering	1	9	MAT/07
Sensors and Microsystems	LM Electrical Engineering	1	9	ING-INF/01
Space Flight Dynamics	LM in Aerospace Engineering	2	9	ING-IND/05
Testing and Validation of Automated Road Vehicles	LM Transportation Engineering and Mobility	1	9	ICAR/05

Course description

Contents and objectives of MOVE courses as well as details about assessment are available at <http://move.dii.unina.it/index.php/study-plans>

Traineeship opportunities

The MOVE Study Program includes a significant curricular internship of 12 ECTS for all attending students. Internships could be carried at the Departments of University of Naples Federico II as well as at External Entities, i.e. companies, public and/or private entities in Italy or in a foreign country that have signed an agreement with the University of Naples Federico II.

Further details about the procedures for internship are available at move.dii.unina.it.

Graduation thesis and exam

The final exam consists in the discussion of a master's degree thesis written, in an original way, by the student under the guidance of one or more university supervisors. The thesis work can also be associated with an in-depth study on a topic addressed during the internship. Usually, the student identifies through informal interviews a teacher willing to entrust him with the thesis work. Alternatively, student can ask the Chair of MS MOVE to identify a supervisor. The supervisor is a professor or researcher belonging to the master's degree course, but external teachers are equally entitled to carry out this task.

The thesis concerns activities of a theoretical, and/or numerical, and/or experimental nature, carried out in a university laboratory, in a research laboratory outside the university as well as in Italian and foreign companies and organizations. The activities must be included in a training period led by the university supervisor.

The final exam is taken by the Candidate in presence of a Commission headed by the Chair of MS MOVE or by another professor of the master's degree course. The candidate is allowed to use audio-visual support. At the end of the presentation, each member of the Commission can address observations to the candidate, relating to the topic of the thesis work. The presentation usually lasts 15 minutes.

International exchange programmes (Erasmus programme)

The MS MOVE takes part to the ERASMUS + student mobility programs to allow students to spend a period of study or carry out an internship at a partner institution belonging to a University of the European Union. Further details are available at

<https://www.unina.it/didattica/opportunita-studenti/erasmus/programma>.

Orientation and Tutoring

Orientation to incoming students

Full information for admission (pre-enrolment, matriculation, accommodation) is available at <http://www.international.unina.it/admission-regulation/>

The International Welcome desk could be reached from foreign countries by e-mail: internationalwelcomedesk@unina.it

Furthermore, several events are organized during the year allowing students to collect information at different levels. A first step deals with information related to job positions, the industrial domain, and the career development along the time. This step is accomplished usually in the mid of February of each year: the calendar of events is available at move.dii.unina.it

As a second step, more specific information related to the choice of the exams and curricula are given through specific events on Spring period of each year (see move.dii.unina.it for the dates).

Tutoring and counselling

A follow-up of the students is done through supervising and mentoring activities: each student is linked to a professor of the board to discuss bi-monthly progresses and difficulties during the education path, in order to: (i) define the needs of the students; (ii) support the choices that better fits the interests of the students, and (iii) catch opportunities (internships, traineeships).

Career orientation and job placement

Students will attend seminars held by experts from the industrial field and enlarge the overview of their working opportunities. Furthermore, specific courses to train soft skills are co-organized with external partners, including final assessment of competences for the improvement of awareness.

A specific event is organized each year including companies related to the industrial field of interest for MOVE engineers (usually in Spring period). A platform managed by the University is available to match working requests and related offers, including stage, traineeship, and job positions): see www.jobservice.unina.it.

Calendar of educational activities and timeline

Application timeline

Enrolment to the first and successive years usually take place from 1st of September to 31st of October of each year. Detailed information about tuition fees is available at <http://www.international.unina.it/admission-regulation/>.

Deadlines and detailed information for submitting study plans and ERASMUS applications as well, are available at move.dii.unina.it.

Academic Calendar: courses and exams

The MS MOVE follows the regulations of the Polytechnic and Basic Sciences School that fixes the duration of teaching activities and examination periods.

Updated details related to the teaching calendar are available at <http://www.scuolapsb.unina.it/index.php/studiare-al-napoli/calendario-delle-attivita-didattiche/2-non-categorizzato/135-calendario-delle-attivita-didattiche-ingegneria>

Details related to the scheduling of examinations are available at <http://move.dii.unina.it/index.php/exam-schedule>

Course Timetable

The scheduling of teaching activities is dynamically updated and available at

<http://easyacademy.unina.it/agendastudenti/index.php?view=rooms&include=rooms& lang=it>

Teaching activities are held at Federico II San Giovanni Campus, Corso Nicolangelo Protopisani, 70, 80146 Naples.

Graduation dates

The Polytechnic and Basic Sciences School fixes the scheduling of final exams usually held on January, March, May, July, September, October, December.

The scheduling of the examination periods and related deadlines for applications are available at <http://www.scuolapsb.unina.it/index.php/laurea-ingegneria>

Contact Persons

Degree Programme Chair

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Sites and links

Site

University of Naples Federico II, San Giovanni Campus
40°50'10.7"N 14°18'22.7"E

Connections

Metropolitan Line 2. San Giovanni-Barra Station.

Degree programme website

move.dii.unina.it

Department website

<http://www.dii.unina.it/>

School website

<http://www.scuolapsb.unina.it/index.php/collegi-e-corsi-di-studio3/collegio-di-ingegneria/laurea-ingegneria>

University website

www.unina.it

Orientation website

<http://www.international.unina.it/admission-regulation/>.
www.orientamento.unina.it