DIDACTIC REGULATIONS OF THE DEGREE PROGRAM

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Regulations in force since the academic year 2025-2026

ACRONYMS

CCD	[Commissione di Coordinamento Didattico]	Teaching Coordination Committee
CdS	[Corso/i di Studio]	Degree Program
CPDS	[Commissione Paritetica Docenti-Studenti]	Joint Teachers-Students Committee
OFA	[Obblighi Formativi Aggiuntivi]	Additional Training Obligations
SUA-CdS	[Scheda Unica Annuale del Corso di Studio]	Annual single form of the Degree Program
RDA	[Regolamento Didattico di Ateneo]	University Teaching Regulation

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Art. 1
Object

1. The present Teaching Regulation governs the organisational aspects of the CdS in Autonomous Vehicle Engineering (LM-33 Mechanical Engineering, ID SUA= 1582404). The CdS in Autonomous Vehicle Engineering (Ingegneria dei Veicoli Autonomi) is hinged in Mechanical Engineering, Department of Industrial Engineering. Teaching language is English.
2. The CdS is governed by the Teaching Coordination Commission (CCD), pursuant to Art. 4 of the RDA.
3. The Teaching Regulation is issued in compliance with the relevant legislation in force, the Statute of the University of Naples Federico II, and the RDA.

Art. 2
Training objectives

The Master's Degree Program in Autonomous Vehicle Engineering (MOVE) aims to train professional engineers who possess a solid cross-cultural knowledge in frontier areas of industrial engineering and ICT, which are of interest to many areas of modern engineering. Such professional engineers will master topics such as:

- Design and management of autonomous land, sea, and air transport systems,
- Information fusion for real-time decision-making,
- Sensors and algorithms for guidance, navigation, and control at a high level of autonomy,
- Autonomous vehicle integration in complex environments.

This is a program entirely delivered in English, with a strong interdisciplinarity as long as an autonomous vehicle engineer has to master ICT technologies such as: control, machine learning, big data, data analytics, computer vision, integrated transport, smart roads, telecommunications, etc., as well as, of course, the applications of these technologies to vehicles, and therefore an adequate knowledge of vehicles is also required. The profile will therefore be that of a system and technology integrator engineer, not that of an aeronautical or automotive or naval designer, nor that of a data science or cutting-edge IT expert, but that of a system engineer who knows how to operate in two fields: one more ‘mechanical’, in the sense of the dynamics and control of means of transport, and one more ‘IT’, in the sense of the autonomous driving and navigation of means of transport. Moreover, it is believed that this interdisciplinary profile will have good job opportunities in general, if only because it overcomes a very frequent limitation in today master's degrees, that of training engineers who are very focused on a specific field and not very transversal, a requirement that is increasingly indispensable in the Industry 4.0 world.

The first-year mechanics and control courses will also include an initial alignment phase, diversified according to the student's previous curriculum, in order to bring everyone up to a common minimum level on the main basic aspects. Special attention in the course is given to the topics of advanced modelling of mechanical systems, design techniques using augmented and virtual reality, and real-time measurement techniques. It then goes on to a phase of acquiring essential transversal skills, such as machine learning, sensor & data fusion, navigation, actuators, image & video processing, digital modelling & simulation, and robust control. The LM MOVE in the final phase includes three tracks:

- self-driving cars,
- autonomous aerial systems,
- autonomous marine vehicles,

for each of these, there is an initial in-depth study of characterising subjects specific to the route, followed by a design teaching session in which the skills acquired will be integrated. This teaching will have a practical design part delivered by dividing the students into groups with specific

responsibilities, which will work in parallel, interacting on the various parts of the autonomous vehicle according to the methods of concurrent engineering, also to enhance teamwork and soft skills. The self-driving cars curriculum also includes teachings on integrating the vehicle into traffic. Internships, apprenticeships and further training activities may be conducted in synergy with the preparation of the final examination for a total of 27 CFUs. Freedom is left to the students in this context (see Notes on other activities).

Art. 3
Professional profile and work opportunities

The professional profile to be trained is that of a mechanical engineer specialising in autonomous vehicles.

Function in a working context:

The function of the master's degree graduate in Autonomous Vehicle Engineering is essentially that of a systems integration expert within teams building and operating autonomous transport vehicles (automotive, aviation, shipbuilding). His main task is that of a systems engineer. Therefore, he may collaborate with mechanical, aerospace and naval engineers specialising in vehicle design and with information area engineers specialising in hardware/software. In this context, he can assume the role of coordinator. His interdisciplinary training in the field of ICT and its applications and in mechanical, aerospace and naval manufacturing engineering enables him to take on increasingly important and required hinge roles in the Industry 4.0 evolution. For the operational use aspects of autonomous systems, the master's graduate will also be able to take on roles as a freelancer or owner of a small service company.

Competencies associated with the function:

Skills are strongly cross-cultural. In the ICT field, skills are acquired in machine learning, big data, robotics, image and video processing, in the industrial field skills in dynamic modelling of mechanical systems and conceptual design.

mechanical systems and concept design. Then there is an intermediate area of competence covering sensor fusion and control systems applied to vehicles and engines, and aeronautical and naval systems. For those interested in self-driving cars, there will be expertise on traffic flow and the integration of the autonomous vehicle into the smart road. The unmanned aerial systems and unmanned marine vehicles tracks will provide in-depth knowledge of autonomous systems in the aeronautical and naval sectors.

Occupational outlets:

The classic occupational outlets for the master's degree in Autonomous Vehicle Engineering are the industries for the construction and operation of means of transport (automotive, aeronautics, naval), organisations and companies for the production and operation of machines, plants and equipment where advanced modelling skills, system control and integration, advanced technologies, certification bodies in the automotive field are relevant, aeronautical and naval, air traffic control bodies, military aeronautics and aeronautical sectors of other weapons, navy and naval sectors of other weapons, civil protection, companies for the use for application purposes of autonomous systems (ground, aeronautical and naval), engineering and research companies in the territory, companies for the use for application purposes of mechanical systems, the liberal professions. With specific reference to the ISTAT-ATECO 2007 classification of productive activities, potential sectors of professional insertion are those corresponding to a multiplicity of activities included in sections B (Mining and quarrying), C (Manufacturing activities), D (Electricity, gas, steam and air conditioning supply), E (Water supply: Networks, Waste Management and Heating Activities), H (Transportation and Warehousing), J (Information and Communication Services), M (Scientific and Technical Professional Activities) and P (Education), in particular groups B-09. 10, B-

09.90, C-29.10, C-30, C-33, C-35, H-49, H-50, H-51, H-52.2, J-62, M-71, M-72.1, M-74.20.12, O-84.22, O-84.24.

Art. 4

Admission requirements and knowledge required for access to the Degree Program[1]

To enroll in the Master's Degree Program in Autonomous Vehicle Engineering, in compliance with Article 6, paragraph 2 of Italian Ministerial Decree No. 270/04, specific access criteria are envisaged concerning the possession of curricular requirements and the compulsory verification of the adequacy of the student's personal preparation, the latter with the procedure defined in Article 5 below.

With regard to the curricular requirements, possession of one of the following two qualifications is required and allows access to the subsequent personal preparation test:

1. degree in class L-9 Industrial Engineering or class L-8 Information Engineering; a minimum number of 12 CFUs in the SSDs ING-IND/08 - Fluid machines, ING-IND/09 - Energy and environmental systems, ING-IND/10 - Industrial technical physics, ING-IND/12 - Mechanical and thermal measurements must be guaranteed in the degree program of origin, ING-IND/13 - Applied mechanics for machines, ING-IND/14 - Mechanical design and construction, ING-IND/15 - Industrial engineering design and methods, ING-IND/16 - Processing technologies and systems, ING-IND/17 - Industrial mechanical systems;
2. a degree in other science or technology degree classes in Italy (L-7 Civil and Environmental Engineering, L-30 Physical Sciences and Technologies, L-31 Computer Sciences and Technologies, L-35 Mathematical Sciences) or a degree obtained abroad (e.g. B.Sc., B.Eng. or B.Tech.) in the field of science or technology provided that it is recognised as suitable by the Teaching Coordination Committee. It must be guaranteed in the degree program of origin both the passing of a minimum number of 36 CFU in the SSD INF/01 - Computer Science, ING-INF/05 - Information Processing Systems, MAT/03 - Geometry, MAT/05 - Mathematical Analysis, FIS/01 - Experimental Physics, and the passing of a minimum number of 12 CFU in the SSD ING-IND/08 - Fluid Machines, ING-IND/09 - Systems for energy and the environment, ING-IND/10 - Industrial physics, ING-IND/12 - Mechanical and thermal measurements, ING-IND/13 - Applied mechanics for machines, ING-IND/14 - Mechanical design and construction of machines, ING-IND/15 - Design and methods of industrial engineering, ING-IND/16 - Processing technologies and systems, ING-IND/17 - Industrial mechanical systems. Finally, for access, knowledge of English is required, at least at a level comparable to B2 of the European Reference Framework for Languages with certification issued by the University or by an accredited body.

Art. 5

Procedures for access to the Degree Program (CdS)

1. The CCD of the Degree Program normally regulates the admission criteria and any scheduling of enrolments, except in cases subject to different provisions of law[2].
2. Verification of personal preparation is always mandatory, and only students who meet the curricular requirements can access it.
3. The CCD shall also regulate, in accordance with guidelines established uniformly for all the Engineering Degree Programs of the Polytechnic and Basic Sciences School, the procedures for verifying the adequacy of the student's personal preparation (pursuant to the Didactic

[1] Artt. 7, 13, 14 of the University Didactic Regulations.

[2] National programmed access is regulated by L. 264/1999 and subsequent amendments and supplements.

Regulations of the Degree Programme and the Decree of the President of the Polytechnic School and Basic Sciences n.176 of 27.11.2015).

- With reference to the qualifications referred to in case 1 of Art.4, students for whom the average of the marks (in thirtieths) obtained in the profit examinations and in any curricular integrations assigned - weighed on the basis of the relative consistencies in CFUs - is not less than 24 are exempt from this verification.

Requests for admission to the MOVE Master's Degree Program from students who do not meet the criteria for automatic admission will be examined by the CCD, which will assess the admissibility of the request with unquestionable judgement, establishing the possible fulfilments to be fulfilled by the interested party for admission to the Master's Degree Programme. The CCD may examine the curriculum followed by the interested party, possibly taking into consideration the marks obtained in characterising courses or in courses considered particularly relevant to the successful completion of the Master's degree programme, or by setting up assessment methods (interviews, tests) to verify the adequacy of the student's personal preparation, or by adopting method C provided for curricular integration in case 2 of Art.4 and reported below.

- With reference to the academic qualifications referred to in case 2 of Art. 4, the CCD assesses the curricular requirements possessed by the candidate and may request the candidate to make a curricular addition to be selected, depending on the extent and nature of the additions requested, from the following options:

A. Curricular integrations to be made before enrolment, pursuant to Art. 6 par.1 of the Ministerial Decree of 16 March 2007, by enrolling in individual teaching courses activated in the University and passing the relative examinations, pursuant to Art. 16 par. 6 of the University Teaching Regulation (see: http://www.unina.it/-/5601348-iscrizione-ai-corsi-singoli);
B. Enrolment in a Degree Course that gives automatic access to the LM MOVE course with an abbreviated pathway and assignment of a Study Plan that includes the curricular integrations required for enrolment in the Master's Degree Course;
C. Enrolment in the Master Degree Course with the assignment of a Study Plan that provides for alignment courses, pursuant to Art. 6 par. 3 of the Ministerial Decree of 16 March 2007, without increasing the number of CFUs.

Art. 6
Teaching activities and university training credit
(Teaching activities and CFU)

Each training activity, prescribed by the CdS detail sheet, is measured in CFU. Each CFU corresponds to 25 hours of overall training commitment[3] per student and includes the hours of teaching activities specified in the curriculum as well as the hours reserved for personal study or other individual training activities.

For the Degree Program covered by this Didactic Regulations, the hours of teaching specified in the curriculum for each CFU, established in relation to the type of training activity, are as follows [4]:

- Lecture or guided teaching exercises: 8 hours per CFU;

[3] According to Art. 5, c. 1 of Italian Ministerial Decree No 270/2004, "25 hours of total commitment per student correspond to university training credits; a ministerial decree may justifiably determine variations above or below the aforementioned hours for individual classes, by a limit of 20 per cent".

[4] The number of hours considers the instructions in Art. 6, c. 5 of the RDA: "of the total 25 hours, for each CFU, are reserved: a) 5 to 10 hours for lectures or guided teaching exercises; b) 5 to 10 hours for seminars; c) 8 to 12 hours for laboratory activities or fieldwork, except in the case of training activities with a high experimental or practical content, and subject to different legal provisions or different determinations by DD.MM.".

- Seminar: 8 hours per CFU;
- Supervised teaching exercises (laboratory or classroom): 8 hours per CFU
- Laboratory activities or fieldwork: 8 hours per CFU;

For internship activities, each credit corresponds to 25 hours of overall training commitment [5].
The CFU corresponding to each training activity acquired by the student is awarded by satisfying the assessment procedures (examination, pass mark) indicated in the Course sheet relating to the course/activity attached to these Didactic Regulations.

Art. 7
Description of teaching methods

The didactic activity is carried out in modality type a): Conventional Degree Program.
If necessary, the CCD decides which courses also include teaching activities offered online.
Some courses may also take place in seminar form and/or involve classroom exercises, and computer laboratories.
Detailed information on how each course is conducted can be found in the course sheets.

Art. 8
Testing of training activities[6]

1. The CCD, within the prescribed regulatory limits[7], establishes the number of examinations and other means of assessment that determine the acquisition of credits. Examinations are individual and may consist of written, oral, practical, graphical tests, term papers, interviews, or a combination of these modes.
2. The examination procedures published in the course sheets and the examination schedule will be made known to students before the start of classes on the Department's website.[8]
3. Examinations are held subject to booking, which is made electronically. In case the student is unable to book an exam for reasons that the President of the Board considers justifiable, the student may still be admitted to the examination, following those students already booked.
4. Before examination, the President of the Board of Examiners verifies the identity of the student, who must present a valid photo ID.
5. Examinations are marked out of 30. Examinations involving an assessment out of 30 shall be passed with a minimum mark of 18; a mark of 30 may be accompanied by honours by a

[5] For Internship activities (Inter-ministerial Decree 142/1998), subject to further specific provisions, the number of working hours equal to 1 CFU may not be less than 25. [please indicate below in the note any different regulatory provisions, e.g., "LM-13: 1 CFU = 30 hours, Note MUR, Director Cuomo, Prot. 570/2011; LM-51, L-24: 1 CFU = 20 hours professional training activity + 5 hours of further supervised training activity, D.M. 654/2022 (Art. 2, practical-assessment Internship)"]
[6] Article 22 of the University Didactic Regulations.
[7] Pursuant to the DD.MM. 16.3.2007 in each Degree Programs the examinations or profit tests envisaged may not be more than 20 (Bachelor's Degrees; Art. 4. c. 2), 12 (Master's Degrees; Art. 4, c. 2), 30 (five-year single-cycle Degrees) or 36 (six-year single-cycle Degrees; Art. 4, c. 3). Pursuant to the RDA, Art. 13, c. 4, "the assessments that constitute an eligibility evaluation for activities referred to in Art. 10, c. 5, letters c), d), and e) of Ministerial Decree no. 270/2004, including the final examination for obtaining the degree, are excluded from the calculation." For Master's Degree Program and single-cycle Master's Degree Program, however, pursuant to the RDA, Art. 14, c. 7, "the assessments that constitute a progress evaluation for activities referred to in Art.10, c. 5, letters d) and e) of Ministerial Decree no. 270/2004 are excluded from the exam count; the final examination for obtaining the Master's Degree and single-cycle Master's Degree is included in the maximum number of exams".
[8] Reference is made to Art. 22, c. 8, of the University Teaching Regulations, which states that "the Department or School ensures that the dates for progress assessments are published on the portal with reasonable advance notice, which normally cannot be less than 60 days before the start of each academic period, and that an adequate period of time is provided for exam registration, which is generally mandatory."

unanimous vote of the Board. Examinations are marked out of 30 or with a simple pass mark. Assessments following tests other than examinations are marked out with a simple pass mark.

6. Oral exams are open to the public. If written tests are scheduled, the candidate has the right to see his/her paper(s) after correction.
7. The University Didactic Regulations govern Examination Boards [9].

Art. 9
Degree Program structure and Study Plan

1. The legal duration of the Degree Program is 2 years. It is also possible to enrol, based on the contract, in compliance with the provisions of Article 24 of the RDA.
   The student must acquire 120 CFU[10], attributable to the following Types of Training Activities (TAF):
   B) characterising,
   C) related or complementary,
   D) at the student's choice[11],
   E) for the final exam,
   F) further training activities.
2. The degree is awarded after having acquired 120 CFU by passing examinations, not exceeding 12, including the final exam, and the performance of other training activities.
   Unless otherwise provided for in the legal framework of University studies, examinations taken as part of basic, characterising, and related or supplementary activities, as well as activities chosen autonomously by the student (TAF D) are taken into consideration for counting purposes. Examinations or assessments relating to activities independently chosen by the student may be taken into account in the overall calculation corresponding to one unit[12]. Tests constituting an assessment of suitability for the activities referred to in Article 10, paragraph 5, letters c), d) and e) of Ministerial Decree 270/2004[13] are excluded from the count. Integrated Courses comprising of two or more modules are subject to a single examination.

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[9] Reference is made to Art. 22, paragraph 4 of the RDA according to which "Examination Boards and other assessments committees are appointed by the Director of the Department or by the President of the School when provided for in the School's Regulations. This function may be delegated to the CCD Coordinator. The Commissions comprise of the President and, if necessary, other professors or experts in the subject. In the case of active courses, the President is the course instructor, and in such cases, the Board can validly make decisions even in the presence of the President alone. In other cases, the President is a professor identified at the time of the Board's appointment. In the comprehensive evaluation of the overall performance at the conclusion of an integrated course, the professors in charge of the coordinated modules participate, and the President is appointed when the Commission is appointed."

[10] The total number of CFU for the acquisition of the relevant degree must be understood as follows: six-year single-cycle Degree, 360 CFU; five-year single-cycle Degree, 300 CFU; Bachelor's Degree, 180 CFU; Master's Degree, 120 CFU.

[11] Corresponding to at least 12 ECTs for Bachelor's Degrees and at least 8 CFU for Master's Degrees (Art. 4, c. 3 of Ministerial Decree 16.3.2007).

[12] Pursuant to the D.M. 386/2007.

[13] Art. 10, c. 5 of Ministerial Decree. 270/2004: "In addition to the qualifying training activities, as provided for in paragraphs 1, 2 and 3, Degree Programs shall provide for: a) training activities autonomously chosen by the student as long as they are consistent with the training project [TAF D]; b) training activities in one or more disciplinary fields related or complementary to the basic and characterising ones, also with regard to context cultures and interdisciplinary training [TAF C]; c) training activities related to the preparation of the final exam for the achievement of the degree and, with reference to the degree, to the verification of the knowledge of at least one foreign language in addition to Italian [TAF E]; d) training activities, not envisaged in the previous points, aimed at acquiring additional language knowledge, as well as computer and telematic skills, relational skills, or in any case useful for integration in the world of work, as well as training activities aimed at facilitating professional choices, through direct knowledge of the job sector to which the qualification may give access, including, in particular, training and guidance programs referred to in Decree no. 142

3. In order to acquire the CFU relating to independent choice activities, the student is free to choose among all the Courses offered by the University, provided that they are consistent with the training project. This consistency is assessed by the Didactic Coordination Commission. Also, for the acquisition of the CFU relating to autonomous choice activities, the "passing the exam or other form of profit verification" is required (Art. 5, c. 4 of Ministerial Decree 270/2004).
4. The study plan summarises the structure of the Degree Program, listing the envisaged teachings broken down by course year and, in case, by curriculum. At the end, the propedeuticities envisaged by the Degree Program are listed. The study plan offered to students, with an indication of the scientific-disciplinary sectors and the area to which they belong, of the credits, of the type of educational activity, is set out in Annex 1 to these Didactic Regulations.
5. Pursuant to Art. 11, paragraph 4-bis, of Ministerial Decree 270/2004, it is possible to obtain the Degree according to an individual study plan that also includes educational activities different from those specified in the Didactic Regulations, as long as they are consistent with the CdS detail sheet of the academic year of enrollment. The individual study plan is approved by the CCD.

Art. 10
Attendance requirements[14]

1. In general, attendance of lectures is strongly recommended but not compulsory. In the case of individual courses with compulsory attendance, this option is indicated in the relative teaching/activity course sheet available in Annex 2.
2. If the lecturer envisages a different syllabus modulation for attending and non-attending students, this is indicated in the individual Course details published on the CdS web page and on the teacher's UniNA website.
3. Attendance at seminar activities that award training credits is compulsory. The relative modalities for the attribution of CFU are the responsibility of the CCD.

Art. 11
Prerequisites and prior knowledge

1. The list of incoming and outgoing propedeuticities (necessary to sit a particular examination) can be found at the end of Annex 1 and in the teaching/activity course sheet (Annex 2).
2. Any prior knowledge deemed necessary is indicated in the individual Teaching Schedule published on the course webpage and on the teacher's UniNA website.

Art. 12
Degree Program Calendar

The Degree Program calendar can be found on the Department website well before the start of the activities (Art. 21, c. 5 of the RDA).

of 25 March 1998 of the Ministry of Labour [TAF F]; e) in the hypothesis referred to in Article 3, paragraph 5, training activities relating to internships and apprenticeships with companies, public administrations, public or private entities including those of the third sector, professional orders and colleges, on the basis of appropriate agreements".

[14] Art. 22, c. 10 of the University Didactic Regulations.

Art. 13

Criteria for the recognition of credits earned in other Degree Programs in the same Class[15]

For students coming from Degree Programs of the same Class, the Didactic Coordination Commission ensures the full recognition of CFU, when associated with activities that are culturally compatible with the training Degree Program, acquired by the student at the originating Degree Program, according to the criteria outlined in Article 14 below. Failure to recognise credits must be adequately justified. It is without prejudice to the fact that the number of credits relating to the same scientific-disciplinary sector directly recognised by the student may not be less than 50% of those previously achieved.

Article 14

Criteria for the recognition of credits acquired in Degree Programs of different classes, in university or university-level Degree Programs, through single courses, at online Universities and in international Degree Programs[16]; criteria for the recognition of credits acquired in extra-curricular activities

1. With regard to the criteria for the recognition of CFU acquired in Degree Programs of different Classes, in university or university-level Degree Programs, through single courses, at online Universities and in International Degree Programs, the credits acquired are recognised by the CCD on the basis of the following criteria:
   - analysis of the activities carried out;
   - evaluation of the congruity of the disciplinary scientific sectors and of the contents of the training activities in which the student has earned credits with the specific training objectives of the Degree Program and of the individual training activities to be recognised.

   Recognition is carried out up to the number of credits envisaged by the didactic system of the Degree Program. Failure to recognise credits must be adequately justified. Pursuant to Art. 5, c. 5-bis, of Ministerial Decree 270/2004, it is also possible to acquire CFU at other Italian universities on the basis of agreements established between the concerned institutions, in accordance with the regulations current at the time [17].
2. Any recognition of CFU relating to examinations passed as single courses may take place within the limit of 36 CFU, upon request of the interested party and following the approval of the CCD. Recognition may not contribute to the reduction of the legal duration of the Degree Program, as determined by Art. 8, c. 2 of Ministerial Decree 270/2004, except for students who enrol while already in possession of a degree of the same level[18].
3. With regard to the criteria for the recognition of CFU acquired in extra-curricular activities, within the limit of 12 CFU the following activities may be recognised:
   - Professional knowledge, skills, and certified skills, taking into account the congruence of the activity carried out and/or of the certified skill with the aims and objectives of the Degree Program as well as the hourly commitment of the duration of the activity.

[15] Art. 19 of the University Didactic Regulations.
[16] Art. 19 and Art. 27, c.6 of the University Didactic Regulations.
[17] Art. 6, c. 9 of the University Didactic Regulations.
[18] Art. 19, c. 4 of the University Didactic Regulations.

- Knowledge and skills acquired in post-secondary-level training activities, which the University contributed to developing and implementing.

Art. 15
Criteria to enrol in individual teaching courses

Enrolment in individual teaching courses, provided for by the University Didactic Regulations[19], is governed by the "University Regulations for enrolment in individual teaching courses activated as part of the Degree Program"[20].

Article 16
Features and modalities for the final examination

The Master's degree in Autonomous Vehicle Engineering is obtained after passing a final examination, consisting of the evaluation by an academic committee of a thesis originally written by the student under the supervision of one or more university lecturers and with the possible collaboration of experts, also from outside the University. The thesis concerns activities of a theoretical, methodological, numerical or experimental nature. Activities carried out outside the university (as interns or trainees), in research laboratories and in Italian and foreign companies and organisations may contribute to the preparation of the thesis, provided that they are part of a training course supervised by the university supervisor. The written report and the discussion must be developed in English and must demonstrate the work carried out, the mastery of the topics covered, the maturity acquired, the ability to work autonomously and a good level of communication skills, including the effective use of IT means.
In order to be admitted to the final examination, the student must have passed all the examinations and acquired the number of CFUs of the internships and all the other training activities envisaged by the Didactic Regulations of the LM MOVE course. The final examination is taken publicly by the Candidate before a Commission chaired by the Course Coordinator or his/her delegate and consists of the presentation of the work carried out under the guidance of a lecturer and subsequent discussion with the members of the Commission. Tutors from outside the academic teaching staff who have been involved in supervising the undergraduate student on specific topics of the course of study developed may be invited to the graduation session as co-rapporteurs, without being part of the Master's Degree Examination Committee.
During the session, the candidate will discuss the thesis, which must be available in the classroom. He/she is allowed to use an audio-visual support to project a summary of the work carried out. At the end of the presentation, each lecturer may address remarks to the candidate relating to the topic of the thesis and/or the MOVE training course. The presentation normally lasts 15 minutes.
The final examination mark is expressed out of one hundred and ten, with possible honours awarded unanimously by the Commission, and the assessment criteria and the awarding of the final grade must also take into account the student's entire career, in terms of quality, continuity and duration.

Article 17
Guidelines for traineeship and internship

1. Students enrolled in the Degree Program may decide to carry out internships or training periods with organisations or companies that have an agreement with the University. Traineeship and internship are compulsory and contribute to the award of credits for the other training activities

[19] Art. 19, c. 4 of the University Didactic Regulations.
[20] R.D. No. 348/2021.

chosen by the student and included in the study plan, as provided for by Art. 10, par. 5, letters d and e, of Ministerial Decree 270/2004[21].

2. The CCD regulates the modalities and characteristics of traineeship and internship with specific regulations.
3. The University of Naples Federico II, through University Traineeship Office http://www.unina.it/en_GB/didattica/tirocini-studenti and COINOR – Traineeship Department https://www.orientamento.unina.it/tirocini-post-laurea/, ensures constant contact with the world of work to offer students and graduates of the University concrete opportunities for internships and work experience and to promote their professional integration.

Article 18
Disqualification of student status[22]

A student who has not taken any examinations for eight consecutive academic years incurs forfeiture unless his/her contract stipulates otherwise. In any case, forfeiture shall be notified to the student by certified e-mail or other suitable means attesting to its receipt.

Article 19
Teaching tasks, including supplementary teaching, guidance, and tutoring activities

1. Professors and researchers carry out the teaching load assigned to them in accordance with the provisions of the RDA and the Regulations on the teaching and student service duties of professors and researchers and on the procedures for self-certification and verification of actual performance[23].
2. Professors and researchers must guarantee at least two hours of reception every 15 days (or by appointment in any case granted no longer than 15 days) and, in any case, guarantee availability by e-mail.
3. The tutoring service has the task of orienting and assisting students throughout their studies and of removing the obstacles that prevent them from adequately benefiting from attending courses, also through initiatives tailored to the needs and aptitudes of individuals.
4. The University ensures guidance, tutoring and assistance services and activities to welcome and support students. These activities are organised by the Schools and/or Departments under the coordination of the University, as established by the RDA in Article 8.

Article 20
Evaluation of the quality of the activities performed

1. The Didactic Coordination Commission implements all the quality assessment forms of teaching activities envisaged by the regulations in force according to the indications provided by the University Quality Presidium.
2. In order to guarantee the quality of teaching to the students and to identify the needs of the students and all stakeholders, the University of Naples Federico II uses the Quality Assurance

[21] Traineeships ex letter d can be both internal and external; traineeships ex letter e can only be external.
[22] Art. 24, c. 5 of the University Didactic Regulations.
[23] R.D No. 2482//2020.

(QA)[24] System, developed in accordance with the document "Self-evaluation, Evaluation and Accreditation of the Italian University System" of ANVUR, using:

- surveys on the degree of placement of graduates into the world of work and on post-graduate needs;
- data extracted from the administration of the questionnaire to assess student satisfaction for each course in the curriculum, with questions relating to the way the course is conducted, teaching materials, teaching aids, organisation, facilities.

The requirements deriving from the analysis of student satisfaction data, discussed, and analysed by the Teaching Coordination Committee and the Joint Teachers' and Students' Committee (CPDS), are included among the input data in the service design process and/or among the quality objectives.

3. The QA System developed by the University implements a process of continuous improvement of the objectives and of the appropriate tools to achieve them, ensuring that planning, monitoring, and self-assessment processes are activated in all the structures to allow the prompt detection of problems, their adequate investigation, and the design of possible solutions.

Article 21
Final Rules

The Department Council, on the proposal of the CCD, submits any proposals to amend and/or supplement these Rules for consideration by the Academic Senate.

Article 22
Publicity and Entry into Force

1. These Rules and Regulations shall enter into force on the day following their publication on the University's official notice board; they shall also be published on the University website. The same forms and methods of publicity shall be used for subsequent amendments and additions.
2. Annex 1 (CdS structure) and Annex 2 (Teaching/Activity course sheet) are integral parts of this Didactic Regulations.

[24] The Quality Assurance System, based on a process approach and adequately documented, is designed in such a way as to identify the needs of the students and all stakeholders, and then translate them into requirements that the training offer must meet.

ANNEX 1

DEGREE PROGRAM DIDACTIC REGULATION

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

STUDY PLAN

KEY

Type of Educational Activity (TAF):
B = Characterising
C = Related or Supplementary
D = At the student's choice
E = Final examination and language knowledge
F = Further training activities

Year I									
Common pathway									
Title Course	**SSD**	**Module**	**Credits**	**Hours**	**Type Activities**	**Course Modalities**	**TAF**	**Disciplinary area**	**Mandatory/ optional**
Control Oriented Models for Vehicles Dynamics	IIND-02/A (ex ING-IND/13)	Single	6	48	Frontal lesson	In-person	B	Mechanical Engineering	Mandatory
Digital Modelling of Interactive Systems and Interfaces	IIND-03/B (ex ING-IND/15)	Single	6	48	Frontal lesson	In-person	B	Mechanical Engineering	Mandatory
Sensor Data Fusion and Measurement Uncertainty Management	IMIS-01/A (ex ING-IND/12)	Smart Sensors and Measurement Uncertainty	6	48	Frontal lesson	In-person	B	Mechanical Engineering	Mandatory
		Sensor Data Fusion	6	48					
Guidance and Navigation	IIND-01/E (ex ING-IND/05)	Single	6	48	Frontal lesson	In-person	C	Mechanical Engineering	Mandatory
Control Architectures for Autonomous Driving	IINF-04/A (ex ING-INF/04)	Control Systems for Autonomous Ground Vehicles	6	48	Frontal lesson	In-person	B	Mechanical Engineering	Mandatory
		Mobile Robots	6	48					
Machine Learning and Big Data	IINF-05/A (ex ING-INF/05)	Single	9	72	Frontal lesson	In-person	B	Mechanical Engineering	Mandatory

Image and Video Processing for Autonomous Driving	IINF-03/A (ex ING-INF/03)	Single	6	48	Frontal lesson	In-person	B	Mechanical Engineering	Mandatory

Year II									
Common pathway									
Title Course	**SSD**	**Module**	**Credits**	**Hours**	**Type Activities**	**Course Modalities**	**TAF**	**Disciplinary area**	**Mandatory/ optional**
Laboratory of Autonomous Vehicle Design and Development	IIND-02/A (ex ING-IND/13)	Autonomous Vehicle Simulation and Experimental Testing	6	48	Frontal lesson	In-person	B	Mechanical Engineering	Mandatory
	IIND-03/B (ex ING-IND/15)	Concept Design of New Vehicles	6	48					

Year II									
Curriculum – Self-Driving Cars									
Title Course	**SSD**	**Module**	**Credits**	**Hours**	**Type Activities**	**Course Modalities**	**TAF**	**Disciplinary area**	**Mandatory/ optional**
Power and Propulsion Systems for UV	IIND-06/A (ex ING-IND/08)	Single	9	72	Frontal lesson	In-person	B	Mechanical Engineering	Mandatory
Smart Roads and Cooperative Driving	CEAR-03/B (ex ICAR/05)	Single	6	48	Frontal lesson	In-person	C	Related or supplementary activity	Mandatory
Student's choice (Table A)			9	72			D		Optional
Internship		Single	12	300	Internship		F		Mandatory
Final test			15				E		Mandatory

Year II									
Curriculum – Unmanned Aerial Systems									
Title Course	**SSD**	**Module**	**Credits**	**Hours**	**Type Activities**	**Course Modalities**	**TAF**	**Disciplinary area**	**Mandatory/ optional**
Systems for autonomous aircraft	IIND-01/E (ex ING-IND/05)	Single	6	48	Frontal lesson	In-person	C	Mechanical Engineering	Mandatory
Design of autonomous aircraft	IIND-01/E (ex ING-IND/05)	Single	9	72	Frontal lesson	In-person	C	Mechanical Engineering	Mandatory
Student's choice (Table A)			9	72			D		Optional

Internship		Single	12	300	Internship		F		Mandatory
Final test			15				E		Mandatory

Year II									
Curriculum – Unmanned Marine Vehicles									
Title Course	**SSD**	**Module**	**Credits**	**Hours**	**Type Activities**	**Course Modalities**	**TAF**	**Disciplinary area**	**Mandatory/ optional**
Unmanned Marine Plants	IIND-01/B (ex ING-IND/02)	Unico	6	48	Frontal lesson	In-person	C	Mechanical Engineering	Mandatory
Design of Autonomous Marine Vehicles	IIND-01/A (ex ING-IND/01)	Unico	9	72	Frontal lesson	In-person	C	Mechanical Engineering	Mandatory
Student's choice (Table A)			9	72			D		Optional
Internship		Single	12	300	Internship		F		Mandatory
Final test			15				E		Mandatory

Table A					
Suggested teaching for autonomous choice					
Title Course	**SSD**	**Credits**	**Hours**	**Source CdS**	**Disciplinary area**
Applied Mechanics for Energy Efficiency	IIND-02/A (ex ING-IND/13)	6	48	LM Mechanical Engineering for Design and Production	Related or supplementary activity
Bio-Inspired Generative Design for Additive Manufacturing	IIND-03/B (ex ING-IND/15)	9	72	LM Mechanical Engineering for Design and Production	Related or supplementary activity
Design of Mechatronic Systems	IIND-03/A (ex ING-IND/14)	9	72	LM Mechanical Engineering for Design and Production	Related or supplementary activity
Mathematical Physics Models	MATH-04/A (ex MAT/07)	9	72	LM Mathematical Engineering	Related or supplementary activity
Sensors and Microsystems	IINF-01/A (ex ING-INF/01)	9	72	LM Electronic Engineering	Related or supplementary activity
Space Flight Dynamics	IIND-01/E (ex ING-IND/05)	9	72	LM Aerospace Engineering	Related or supplementary activity
Testing and Validation of Automated Road Vehicles	CEAR-03/B (ex ICAR/05)	9	72	LM Transportation Engineering and Mobility	Related or supplementary activity

ANNEX 2

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

TEACHING/ACTIVITY COURSE SHEET

ANNEX 2.1

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Electrical Engineering and Information Technology

Didactic Regulations in force since the academic year 2025-2026

Course: CONTROL ARCHITECTURES FOR AUTONOMOUS DRIVING	**Teaching Language:** English
SSD (Subject Areas): IINF-04/A (ex ING-INF/04)	**CREDITS:** 12
Course year: I	**Type of Educational Activity:** B
Teaching Methods: In-person	
Contents extracted from the SSD declaratory consistent with the training objectives of the course: The sector studies methods and technologies for information processing aimed at automation (i.e., planning, management, and control, carried out automatically) of plants, processes, and dynamic systems in general. Such terms may include, for example, automatic operating machines (including robot systems), transport systems (ITS) and avionics systems.	
Objectives: The course objectives address the following domains: Control Systems for Autonomous Ground Vehicles (CSAGV) and Mobile Robots (MR). With reference to CSAGV the course is intended to provide general knowledge about the design of current and next generation control architectures for autonomous vehicles. Namely, it provides skills for designing intelligent ground vehicles, and related innovative applications in ITS and focuses on design, modelling, and control of highly interactive cyber-physical systems. In so doing, it integrates the expertise and attitude of modern industrial engineering topics (i.e., vehicles) with recent advances in ICT. With reference to MR, the course provides knowledge about the design of current and next generation control architectures for autonomous wheeled mobile robot planners and controller, including the implementation of autonomous navigation systems for mobile robots starting from the reconstruction of its pose with wheel encoders, the generation of control inputs, and the knowledge of the environment.	
Propaedeuticities: None **Is a propaedeuticity for:** None	
Types of examinations and other tests: The oral exam is focused on the presentation of a project and the assessment of course contents	

ANNEX 2.2

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: CONTROL ORIENTED MODELS FOR VEHICLES DYNAMICS	**Teaching Language:** English	
SSD (Subject Areas): IIND-02/A (ex ING-IND/13)		**CREDITS:** 6
Course year: I	**Type of Educational Activity:** B	
Teaching Methods: In-person		
Contents extracted from the SSD declaratory consistent with the training objectives of the course: Systemic approach for the design of a mechanical system: mechatronic system; passive, semi-active and active controls; feedforward and feedback controls Modelling of mechanical systems: d'Alembert and Newton approaches, Lagrange approach, linear time-invariant mechanical systems, nonlinearities in mechanical systems, linearization technique State-space modelling, input-output modelling, transfer function, Laplace domain, Laplace transform, stability analysis Control of mechanical systems in terms of vibrational characteristics		
Objectives: The course aims to provide the fundamental knowledges for the synthesis of physical-mathematical models of mechanical systems according to an approach that is functional to the design of the model-based controllers. The methodologies for modelling, the main sources of mechanical nonlinearities, as well as local linearization based tools are described, starting from the typical features of the mechanical systems, with particular reference to vehicle dynamics.		
Propaedeuticities: None **Is a propaedeuticity for:** None		
Types of examinations and other tests: Oral		

ANNEX 2.3

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: DESIGN OF AUTONOMOUS AIRCRAFT		**Teaching Language:** English
SSD (Subject Areas): IIND-01/E (ex ING-IND/05)		**CREDITS:** 9
Course year: II	**Type of Educational Activity:** C	
Teaching Methods: In-person		
Contents extracted from the SSD declaratory consistent with the training objectives of the course: The sector studies aeronautics and space systems both on the whole and with reference to the interaction and integration aspects of the subsystems that realize the configuration, in relation to the achievements of mission goals. Aspects of investigations are: subsystems and sensors needed for guidance navigation and control, design and experimentation of onboard/ground systems		
Objectives: The course is intended to: - complete student knowledge about key technologies for unmanned/autonomous aircraft; - provide insight and hands-on experience on state-of-the-art approaches and technologies; - present practical cases of design and development of autonomous aircraft technologies (exploiting the potential of advanced simulation environments, working with experimental datasets and/or with real hardware, introducing the possibilities offered by mixed approaches).		
Propaedeuticities: None **Is a propaedeuticity for:** None		
Types of examinations and other tests: Oral and Project Discussion		

ANNEX 2.4

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: DESIGN OF AUTONOMOUS MARINE VEHICLES	**Teaching Language:** English
SSD (Subject Areas): IIND-01/A (ex ING-IND/01)	**CREDITS:** 9
Course year: 2024/25	**Type of Educational Activity:** C

Teaching Methods:

In-person

Contents extracted from the SSD declaratory consistent with the training objectives of the course:

The scientific sector includes all aspects pertinent to the hull design. These are: the development of the hull body and of the propulsion system (both conventional and non-conventional); the verification of stability, seakeeping and manoeuvrability requirements, in order to guarantee the safety of navigation and the comfort on board.

Objectives:

- provide knowledge on different types, mission profiles and general layouts of unmanned/autonomous marine vehicles.
- provide the fundamentals for the design of unmanned/autonomous marine vehicles by focusing on hands-on experience from state-of-the-art approaches and technologies.
- present design cases and development of autonomous marine vehicles.

Propaedeuticities:

None

Is a propaedeuticity for:

None

Types of examinations and other tests:

Oral Exam and project discussion.

ANNEX 2.5

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Regulations in force for the academic year 2025-2026

Course: DIGITAL MODELLING OF INTERACTIVE SYSTEMS AND INTERFACES	**Teaching Language:** English
SSD (Subject Areas): IIND-03/B (ex ING-IND/15)	**CREDITS:** 6
Course year: I	**Type of Educational Activity:** B

Teaching Methods:
In-person

Contents extracted from the SSD declaratory list consistent with the learning objectives of the course:
"The morphological, functional, and aesthetic study of design solutions is combined with the development of representation methods, including operational simulation and virtual prototypes. The principles and methods of design and the associated tools of representation, modelling, and simulation are covered with reference to the various industrial sectors: aerospace, mechanical engineering, shipbuilding, and plant engineering."

Objectives:
The course aims at providing students with tools and methods for designing interactive systems and interfaces by using multidomain modeling, simulations, and virtual prototyping. At the end of the course, the student will be able to: develop 3D models of mechanical assemblies; choose appropriate graphics and technical communication tools for the design of mechanical systems; assign and evaluate characteristics and properties of mechanical systems in a virtual environment: shapes, proportions, materials, tolerances, appearance; manage reference protocols for data exchange; execute finite element structural analysis (FEM) in virtual environment on mechanical parts and assemblies; develop multidomain models and simulations using MATLAB Simscape environment; simulate the behaviour of electro-mechanical systems.

Propaedeuticities:
None

Is a propaedeuticity for:
None

Types of examinations and other tests:
The oral exam is focused on the presentation of a project and the assessment of course contents.

ANNEX 2.6

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: GUIDANCE AND NAVIGATION	**Teaching Language:** English
SSD (Subject Areas): IIND-01/E (ex ING-IND/05)	**CREDITS:** 6
Course year: I	**Type of Educational Activity:** C
Teaching Methods: In-person	
Contents extracted from the SSD declaratory consistent with the training objectives of the course: The subject area studies aeronautical and space systems as a whole and the aspects of sub-system interaction and integration, in relation to the achievement of mission objectives. Topics of interest include the definition of the functional architecture for the individual units and the design, the identification of functional components, the effect of the external environment and dynamic interactions on each system and subsystems. The sector makes use of specific survey methodologies, such as simulation for experimental, analytical and numerical modeling.	
Objectives: The course is intended to provide the needed knowledge to design and develop efficient guidance and navigation solutions for autonomous vehicles. Guidance is the development of the mission plan, i.e. the 3D or 4D trajectory for the vehicle, depending on the type of transport systems. Guidance can be strategic or tactical depending whether it is realized before the mission is started or not. Navigation is the function that provides information about position, velocity, and orientation for the vehicle. It is accomplished by integrating measurement from different sources, such as sensors and receivers.	
Propaedeuticities: None **Is a propaedeuticity for:** None	
Types of examinations and other tests: Written and oral	

ANNEX 2.7

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Electrical Engineering and Information Technology

Didactic Regulations in force since the academic year 2025-2026

Course: IMAGE AND VIDEO PROCESSING FOR AUTONOMOUS DRIVING	**Teaching Language:** English
SSD (Subject Areas): IINF-03/A (ex ING-INF/03)	**CREDITS:** 6
Course year: II	**Type of Educational Activity:** B

Teaching Methods:
In-person

Contents extracted from the SSD declaratory consistent with the training objectives of the course:
The SSD studies methods and tools for processing mono/multidimensional signals for the purposes of filtering, redundancy reduction, synthesis, extraction of information elements; pattern recognition for semantic interpretation of the information content in signals and images.

Objectives:
The aim of the course is to provide students with basic notions and algorithms for processing digital images and videos, with special focus on autonomous driving vehicles. Beyond providing the mathematical and conceptual tools, the course aims to provide the knowledge needed to develop the main algorithms for image processing using Python.

Propaedeuticities:
None

Is a propaedeuticity for:
None

Types of examinations and other tests:
The exam consists in a computer test and an oral exam. The practical test consists in solving three exercises in Python on image processing applications as developed during the lab, while the oral the aim is also to assess the knowledge of all the concepts and contents given during the course lectures.

ANNEX 2.8

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: LABORATORY OF AUTONOMOUS VEHICLES DESIGN AND DEVELOPMENT	**Teaching Language:** English
SSD (Subject Areas): IIND-02/A (ex ING-IND/13) – IIND-03/B (ex ING-IND/15)	**CREDITS:** 12
Course year: II	**Type of Educational Activity:** B

Teaching Methods:
In-person

Contents extracted from the SSD declaratory consistent with the training objectives of the course:
The SSD IIND-02/A includes the cultural and professional aspects inherent in the study of mechanical systems through the methodologies of theoretical mechanics. The typology of the machines studied is completely general; however, extensive reference is made to driving and operating machines, mechanical devices, automatic machines and robots, vehicles and biomechanical systems. In particular, both the analysis and the synthesis of the mechanical behaviour of the machines and systems indicated above are studied. The analysis is articulated in the modelling, simulation, regulation and control of the same; the synthesis is aimed at their functional design. Particular emphasis is placed on the study of vibratory and tribological phenomena of machines.
The SSD IIND-03/B studies methods and tools for developing a technically valid design in industrial engineering. It is the reasoned and innovative choice of technical solutions that can be perfected through the systematic use of rational methods for designing and optimising machines; therefore, it is a fundamental expression of technical creativity.

Objectives:
Concerning AVSET, the course is intended to provide the student with the fundamentals of motion planning and control strategies of mechanical systems to develop a system with autonomous guidance. The module covers advanced topics of modelling that represent the starting point to develop autonomous vehicle prototypes, by means of laboratory experiences of simulations and experimental tests.
Concerning CDNV, the course deals with the concept design of new autonomous vehicles, covering advanced topics from new ideas to functional simulation. The module aims to provide students with methods and tools for requirements engineering, system architecture definition, concept generation, and concept selection. Starting from the design needs, the students will acquire the ability to: define functional and non-functional requirements; develop SysML diagrams; define the requirements list; develop functional and logical architectures; define and trace relationships among requirements and architectures; test and verify model performances against requirements; generate product concepts; select the most promising product concept; design a concept for a new and innovative vehicle.

Propaedeuticities:
None

Is a propaedeuticity for:

None

Types of examinations and other tests:

The oral examination for both modules focuses on the presentation of a project. In addition, the oral exam also aims to assess the knowledge of all the concepts and contents given during the course lectures. The final mark of the course Laboratory of Autonomous Vehicle Design and Development will be calculated by the Examination Committee as the average of the marks of the two modules, which have equal weight.

ANNEX 2.9

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING (MOVE)

LM-33

School: Polytechnic and Basic Sciences School

Department: Electrical Engineering and Information Technology

Didactic Regulations in force since the academic year 2025-2026

Course: MACHINE LEARNING AND BIG DATA		**Teaching Language:** English
SSD (Subject Areas): IINF-05/A (ex ING-INF/05)		**CREDITS:** 9
Course year: I	**Type of Educational Activity:** B	
Teaching Methods: In-person		
Contents extracted from the SSD declaratory consistent with the training objectives of the course: Data Mining and Machine Learning. Knowledge representation: Trees, Rules, Clusters. Basic Machine Learning methods: Statistical Modelling, Linear Models, Instance-based learning, Clustering. Performance Evaluation: Cross-Validation, Cost-sensitive classification, ROC curves. Advanced Machine Learning: Decision Trees, Support Vector Machines, MLP. Data transformation: attribute selection, PCA. Deep Learning: training and performance evaluation of Deep Networks, Convolutional Neural Networks. Introduction to database systems. Data model for Big Data. NoSQL database: Key-value-Column-family, Graph database systems. Introduction to Big Data systems (BD): definition of a BD system. The Hadoop ecosystem. Yarn. Pig. Hive. Giraph. Spark. Introduction to Big Data Analytics (BDA): BDA Lifecycle: knowledge discovery in the database, data preparation, model planning, model building, data visualization. Examples of commercial and open-source Tools: Oracle, IBM Business Analytics, Microsoft Power BI, Microsoft Azure. AWS. SAP Hana.		
Objectives: The student must know the main Machine Learning (ML) algorithms and must demonstrate the ability to choose the most suitable ML algorithm to solve a specific problem, based on the requirements of the problem itself. The student must also know the techniques to be used for properly evaluating the performance of ML algorithms. The students must know the main Big Data frameworks in order to acquire, model, share, analyze and visualize large amount of information. The student must also demonstrate that he/she is able to choose the most suitable framework to deal with different tasks. The student must demonstrate to be able to solve real problems by using Machine Learning techniques. The student must also demonstrate that he/she can properly evaluate the performance of a machine-learning based system. The student must demonstrate to be able to manage, model and analyze large amount of data through different Big Data frameworks for dealing with different tasks, also evaluating the performance of the designed architecture.		
Propaedeuticities: None **Is a propaedeuticity for:** None		
Types of examinations and other tests: Oral examination and project discussion.		

ANNEX 2.10

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: POWER AND PROPULSION SYSTEMS FOR UV		**Teaching Language:** English
SSD (Subject Areas): IIND-06/A (ex ING-IND/08)		**CREDITS:** 9
Course year: II	**Type of Educational Activity:** B	
Teaching Methods: In-person		
Contents extracted from the SSD declaratory consistent with the training objectives of the course: The sector studies the thermodynamic, fluid dynamics, energy, ecological, technological and environmental problems of fluid machines. The sector's skills cover the design, management, diagnostics, control, environmental impact, experimentation, and testing aspects of fluid machines (internal combustion engines). The sector also studies propulsion systems.		
Objectives: The course aims at providing students with advanced notions related to the design and management of the propulsion systems of ground unmanned vehicles. Notions cover the operation of powertrain components and their integration, with particular focus on energy efficiency and environmental impact.		
Propaedeuticities: None **Is a propaedeuticity for:** None		
Types of examinations and other tests: Project discussion		

ANNEX 2.11

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: SENSOR DATA FUSION AND MEASUREMENT UNCERTAINTY MANAGEMENT	**Teaching Language:** English
SSD (Subject Areas): IMIS-01/A (ex ING-IND/12)	**CREDITS:** 12
Course year: I	**Type of Educational Activity:** B

Teaching Methods:
In-person

Contents extracted from the SSD declaratory consistent with the training objectives of the course:
"The SSD studies tend to develop research and expertise on methods of analysis, design and testing of systems for the measurement of mechanical and thermal quantities for both science and industrial applications, including those related to human well-being. In general, they address problems concerning the integrated design of tools for the monitoring, diagnosis and control of any system affected by mechanical and thermal quantities. Therefore, in addition to general metrology and specific instrumentation skills, skills related to the operation of the equipment to be tested, the systems to be monitored and the systems to be controlled are required."

Objectives:
The learning objective of the integrated course is providing students with the capability of defining, implementing, and assessing navigation devices integrating different measurement sensors suitably fused to overcome typical limitations. In particular, the module Smart Sensors and Measurement Uncertainty is intended to provide the general knowledge about measurement systems and sensors as well as their metrological characteristics. Moreover, uncertainty estimation in direct and indirect measurements according to the current recommendation must be mastered by the students. The module Sensor Data Fusion is intended to present, from both theoretical and experimental point of view, methods, and algorithms for acquired data processing. Moreover, particular attention will be paid to the real-time data transmission and processing from the smart sensor realized by means of an embedded system and an external high-performance computational unit, such as digital signal processor or personal computer.

Propaedeuticities:
None

Is a propaedeuticity for:
None

Types of examinations and other tests:
The exam is carried out by means of combination of written and oral examination as well as practical tests nad project discussion.

ANNEX 2.12

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Civil, Building and Environmental Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: SMART ROADS AND COOPERATIVE DRIVING	**Teaching Language:** English	
SSD (Subject Areas): CEAR-03/B (ex ICAR/05)		**CREDITS:** 6
Course year: II	**Type of Educational Activity:** C	
Teaching Methods: In-person		
Contents extracted from the SSD declaratory consistent with the training objectives of the course: Analysis of the phenomena of the mobility of people and goods for the configuration of the best system from technological, functional, and other aspects. Identification and development of technologies peculiar to the different modes of transport for regulation and control of mobility systems.		
Objectives: The course provides students with a clear and deep understanding of the technical and functional requirements to be satisfied for vehicle/road interaction in connected and automated driving scenarios. Students acquire knowledge in digital road transformation, understanding the potential of new technologies for solving road and traffic flow problems. Students understand how to deal with V2-X communication systems and C-ITS services in a context in which roads are equipped with traffic sensors.		
Propaedeuticities: None **Is a propaedeuticity for:** None		
Types of examinations and other tests: Oral		

ANNEX 2.13

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: SYSTEMS FOR AUTONOMOUS AIRCRAFT	**Teaching Language:** English
SSD (Subject Areas): IIND-01/E (ex ING-IND/05)	**CREDITS:** 6
Course year: II	**Type of Educational Activity:** C
Teaching Methods: In-person	
Contents extracted from the SSD declaratory consistent with the training objectives of the course: The sector studies aeronautics and space systems both on the whole and with reference to the interaction and integration aspects of the subsystems that realize the configuration, in relation to the achievements of mission goals. Aspects of investigations are: subsystems and sensors needed for special applications like navigation and remote sensing.	
Objectives: The course is intended to provide students with knowledge of engineering problems related to design and operations of unmanned aircraft system. The course tackles the problem of autonomy for aircraft with specific reference to unmanned aircraft systems. UAS are natively realized to perform most of the tasks in an automatic fashion. Very high level of automation, where a number of subsequent decision branches are programmed into the on-board computer, progressively enables fully autonomous aircraft operations. The course covers basic topics of flight dynamics and control, and applies standard concepts of linear system control theory to enable the design of the onboard autopilot and its integration with autonomous tasks to be performed at higher system level, e.g. path planning and management.	
Propaedeuticities: None **Is a propaedeuticity for:** None	
Types of examinations and other tests: Oral	

ANNEX 2.14

DEGREE PROGRAM DIDACTIC REGULATIONS

AUTONOMOUS VEHICLE ENGINEERING

CLASS LM-33

School: Polytechnic and Basic Sciences School

Department: Industrial Engineering

Didactic Regulations in force since the academic year 2025-2026

Course: UNMANNED MARINE PLANTS		**Teaching Language:** English
SSD (Subject Areas): IIND-01/B (ex ING-IND/02)		**CREDITS:** 6
Course year: II	**Type of Educational Activity:** C	
Teaching Methods: In-person		
Contents extracted from the SSD declaratory list consistent with the learning objectives of the course: The sector is divided into three basic areas: naval structures, marine structures and naval plants. The naval systems branch studies the propulsion systems (from the point of view of design and operation), the systems necessary for on-board services, the equipment necessary for the safety of the ship and the automatic management and control systems.		
Learning objectives: The course aims to provide the student with the basic knowledge of the propulsion and auxiliary systems of marine vessels, particularly with reference to automatic management. Furthermore, notions will be provided for the integration of these devices with each other, with navigation systems and remote control station. Safety and regulatory issues will also be considered in the course. Students will be given indications to use a simulator in dedicated software environment.		
Pre-requisites: None **Is a pre-requisite for:** None		
Types of examinations and other tests: Oral exam is focused on assessing knowledge of the course contents. Students can present a simple project on one of the ship systems shown during the course or comment on a system proposed by the examination commission.		