Degree Programme - General Information

University	University of Modena and Reggio Emilia
Degree Programme Name (Italian)	Ingegneria del Veicolo ad Alte Prestazioni*(SuaID:1537642)*
Degree Programme Name (English)	Advanced Automotive Engineering
Class	LM-33 - Mechanic Engineering
Degree Programme language	English
Degree Programme Website (if any)	http://www.aae.unimore.it
Fees	http://www.unimore.it/ammissione/tasse.html
Degree Programme Type	a. Conventional

Contacts and Facilities

President (or Reference Person or Coordinator) of the Study Programme	LEALI Francesco
Collegiate Body for the study programme management	Study Programme Board
Reference educational department	'Enzo Ferrari' Engineering

Contact Professors

No.	LAST NAME	FIRST NAME	AREA	TITLE	WEIGH	SDS TYPE
1.	BASSOLI	Elena	ING-IND/16	AP	1	Distinctive
2.	IMMOVILLI	Fabio	ING-IND/32	RD	1	Related
3.	ZANASI	Roberto	ING-INF/04	FP	1	Related
4.	BONDIOLI	Federica (University of Parma)	ING-IND/22	AP	1	Related
5.	CAVINA	Nicolo (University of Bologna)	ING-IND/08	AP	1	Distinctive
6.	VERTECHY	Rocco (University of Bologna)	ING-IND/13	AP	1	Distinctive
7.	FRANCESCHINI	Giovanni (University of Parma)	ING-IND/32	FP	1	Related
8.	MUCCHI	Emiliano (University of Ferrara)	ING-IND/13	RD	1	Distinctive
9.	RAVAGLIOLI	Vittorio (University of Bologna)	ING-IND/08	RD	1	Distinctive

Students' Representatives	Bellucci Andrea Bompani Davide Bursi Edoardo Ciancia Antonio Coelli Daniele Faenza Francesco Guerzoni Andrea Manfo Teboko William Papazzoni Daniele Rambaran Dhansaw
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Tutor	Francesco PELLICANO

The Degree Programme in brief

16/02/2017

The Master's Degree Programme in Advanced Automotive Engineering is an Interuniversity International Programme with administrative office at the University of Modena and Reggio Emilia. It is offered in collaboration with the Universities of Bologna, Ferrara and Parma and with the partnership of the most important companies operating in the automotive sector of Emilia-Romagna.

The degree programme is aimed at providing the knowledge and the skills required for designing high-performance and racing motor vehicles and motor cycles. The main features of the Degree Programme are as follows:
- Professors selected by an Interuniversity Coordination Committee, which is open to the partnership of companies, among university professors and Italian and foreign expert professionals, as to ensure the highest quality of education.
- students admitted to the degree programme after a careful evaluation of their merits and a technical and motivational interview, and based on their ranking and the interests stated, assigned to each of the six curricula in which the Degree Programme is organised.
- A first semester in common for all students, taking place at the Enzo Ferrari Department of Engineering of the University of Modena and Reggio Emilia, aimed at providing the basic skills.
- Six curricula (max. 25 places each): Advanced Powertrain- Modena (held at the university of Modena) Advanced Powertrain Bologna (held at the university of Bologna from the 2nd semester), High Performance Car Design (held at the university of Modena), Racing Car Design (held at the university of Parma from the 2nd year), Advanced Motorcycle Engineering (held at the university of Bologna), Advanced Sports car Manufacturing held at the university of Bologna).
- Courses fully provided in English and offering both a theoretical part and workshop activities at the Universities and in the laboratories of the industrial partner companies, in order to develop high-level professional skills based on a Learning by Doing approach.
- Compulsory internships and activities aimed at preparing the degree thesis, organised in a Project Working mode and taking place within the most industrial realities of the automotive sector and in university research laboratories.

FRAMEWORK A1.a	**Consultation with the representative organisations of good manufacturers, service providers, and professions, at a national and international level (Degree programme set up)**

25/01/2017

UNIVERSITY BODY OR PERSON RESPONSIBLE FOR THE CONSULTATION

The Boards of the Degree Programmes offered in the LM-33 class at the universities involved in the interuniversity project include operating Orientation Committees that are periodically called to determine the professional requirements, the guidelines and the instructions of the stakeholders and the industrial world in particular.

More specifically, at the University of Modena and Reggio Emilia, where a Degree Programme in Advanced Automotive Engineering is offered and many educational training activities are carried out in collaboration with the most renowned companies in the region (Vocational Masters, PhDs, Specialisation courses), a University Coordination team has been appointed and assigned the specific function of defining and developing a University strategic line in the Automotive field. Such policy has led to the presentation of a project aimed at creating an INTERNATIONAL ACADEMY FOR ADVANCED TECHNOLOGIES IN HIGH-PERFORMANCE VEHICLES AND ENGINES. The project (ANNEX 1) has been financed by the Ministry for Education, University and Research (pursuant to Art. 11 of Min. Decree no. 335 of 8th June, Criteria for the Allocation of the Ordinary Financing Fund (FFO) for the year 2015) as an extraordinary action of strategic importance for the University programming and connected with the research, education and internalisation fields.

In connection with the planning of the International Master's Degree Programme in Advanced Automotive Engineering, an interuniversity committee has been established with the assistance of the Department coordinating the European policies in terms of development, school, professional training, university, research and development of the Emilia Romagna region, made of the Rectors (or their delegates) of the Universities of Bologna, Ferrara, Modena and Reggio Emilia, Parma, and the representatives of the Technical and Human Resource Management of: Automobili Lamborghini Spa, Dallara Automobili SpA, Ducati Motor Holding Spa, FCA Group - Maserati e Alfa Romeo, Ferrari Spa, Magneti Marelli Spa, Scuderia Toro Rosso Spa.

The consultation activities carried out within the interuniversity body, led to a discussion on the programme name, the job opportunities it offers, the training requirements and the training objectives provided in a first designing concept, along with a brief description of the general framework of the overall training activities and more specifically to the most distinctive of the Programme, in addition to the features of the final examination for obtaining the qualification. The results are outlined in the Minutes of the Consultation of the social partners and related annexed documents (ANNEX 2).

ORGANISATIONS THAT HAVE BEEN CONSULTED DIRECTLY OR THROUGH DOCUMENTS OR SECTOR STUDIES

In addition to the persons directly involved within the Guidance Committees of the Study Programmes available and the companies involved in the design phase o of the International Degree Programme in Advanced Automotive Engineering, a sector study aimed at analysing the competitiveness of the Modena Automotive sector was commissioned to the AlixPartners company

, and is attached to the Minutes of Consultation of the social partners (ANNNEX 2). Further information is included in the Study Programme Project document.

DETAILS AND FREQUENCY OF STUDIES AND CONSULTATIONS

The Orientation Committees meet at least once a year. Their meetings are coordinated by the President of the Study Programme and are aimed at assessing the training quality of new graduates, at collecting information that is useful to continuously improve the educational offer. The regional committee met on the following dates:

During 2016, the relationships with local automotive industries were started and consolidated, in order to determine the real requirements, also involving the Region and the neighbouring Universities.

Mainly between September and November 2016, the interuniversity committee held various meetings, which focused on the alignment between the demand of participating industrial groups, among the most important and renowned in the world, and the educational offer of the regional universities. Such meetings were held on the following dates: 4/10/2016, 11/10/2016, 21/10/2016, 24/10/2016, 4/11/2016, 8/11/2016, 25/11/2016, 28/11/2016.

DOCUMENTATION (DIGITAL LINKS TO MINUTES OR OTHER EVIDENCE ON SURVEYS AND DECISIONS

ASSUMED)
Attached to a single .pdf file are both the Automotive Academy UNIMORE (ANNEX 1) and the minutes of the consultation with the social partners along with the relevant annexes (ANNEX 2). Further information is included in the Study Programme Project document.

Pdf attached: view

FRAMEWORK A1.b	**Consultation with the representative organisations of good manufacturers, service providers, and professions, at a national and international level (future consultations)**

14/02/2017

The Degree Programme is a new one.

Role in a working environment:
The Advanced Automotive Engineer is a professional with an industrial, as well as an initial mechanic/mechatronic basic knowledge who, based on a complete overview of the vehicle system, is able to design, develop and make the main subsystems featured in road auto and motor vehicles, with specific reference to the premium segment of the market and of racing vehicles, and develop and manage the relevant manufacturing and technological processes.
The main functions of the Advanced Automotive Engineer in a working environment are the vehicle asset, the design and development of the main subsystems and components relating to: thermal, hybrid and electric powertrain, inclusive of energy storage and conversion solutions, and related modelling and controlling issues; cold architecture of road vehicles and motor vehicles, both in the industrial and racing fields; production systems featuring typical aspects of the new industry 4.0 scenario (industrial robotics, design and management of the supply chain, big data, etc.).
The greatest strength of this professional profile is that it involves multiple disciplines, although, given the increasing complexity of new generation road vehicles, along with the consequent and progressive specialisation of the functions and the tasks that Advanced Automotive Engineers must be responsible for in companies, five specific professional profiles have been defined in collaboration with the industrial partners, and are described below:
1. Advanced Automotive Engineer, expert in the road vehicle architecture: responsible for setting up and developing the vehicle system, starting from the understanding of the fundamental aspects, and designing all main cold units and subunits of high-performance road vehicles.
2. Advanced Automotive Engineer, expert in the racing vehicle architecture: responsible for setting up and developing the vehicle system, starting from the understanding of the fundamental aspects, and designing all main cold units and subunits of high-performance road vehicles. Compared to the previous one, this AAE is more specialised in terms of aerodynamics, use of lightweight materials (Carbon Fibre Reinforced Materials), and has a strong ability in carrying out experimental activities.
3. Advanced Automotive Engineer, expert in powertrain systems: responsible for designing and collaborating in traditional and innovative powertrain system engineering, focusing on their optimisation, as well as on controlling and solving environmental and energy issues.

4. Advanced Automotive Engineer, expert in motor vehicles: responsible for designing and developing high-tech motor vehicles, both standard and racing-specific. The AAE deals with and manages aspects that are typical of electronic engineering and industrial design, specific to motor vehicles.
5. Advanced Automotive Engineer, expert in production activities: responsible for training engineers and teach them how to plan, develop, control and manage production systems in the automotive sector. The main areas of knowledge covered by the teachings are as follows: process engineering, industrial system design, production management and optimisation, automation technologies and solutions, digital technologies of the factory 4.0 and quality control process management.
In addition to technical and engineering skills, interdisciplinary skills are required, aimed at communicating the technical contents, project working, and continuously refining the theoretical and practical skills through a “learning by doing” approach.

Skills associated with the function:
The functions associated with the profile of the Advanced Automotive Engineer, expert in the road vehicle architecture, require specialist skills in the main drawing and design aspects, vehicle constructions, vehicle dynamics and Noise Vibration Harshness, material behaviour, mechanic technology, aerodynamics, thermofluidodynamics, automated control, electronics and sensors.
The functions associated with the profile of the AAE expert in the racing vehicle architecture require specific skills in terms of: vehicle setting, vehicle mechanics, structural calculations with lightweight materials, composites and materials for additive manufacturing, aerodynamics and vehicle dynamics.
The functions associated with the profile of the Advanced Automotive Engineer, expert in powertrain systems, require skills in modelling, optimisation, controlling and solving environmental and energy issues relating to traditional and innovative powertrain systems. Specific skills range from the study of internal combustion engines, electric powertrain systems, solutions for the conversion and storage of electromechanical energy and the main powertrain design and production technologies, up to the study of the most advanced control and calibration techniques.
The functions associated with the motor vehicle expert profile of the Advanced Automotive Engineer require specific skills that are typical of electronic engineering and industrial design, relating to drawing, vibration mechanics, mechanic technology, motor vehicle dynamics, design of endothermal and BEV powertrains, development of DAS (Drive Assistance Systems).
The functions associated with the manufacturing expert profile of the Advanced Automotive Engineer require specialist skills in: process engineering, industrial system design, production management and optimisation, automation technologies and solutions, digital technologies of the factory 4.0 and quality control process management.

Job opportunities:
The main job opportunities offered by the master’s degree programmes of this class are related to the innovation and development of products and processes, advanced designing, production planning and programming, and complex system management in manufacturing or service companies that deal with the design and production of vehicles and motor vehicles of the premium or racing segment of the market, in their relevant production chains, operating in the international field.
Graduates in Advanced Automotive Engineering may continue their studies by completing their preparation in a PhD School or a 2nd level Master.
Master graduates also possess the skills and the requirements in accordance with the applicable legislation to work as Engineers in the various specialisations that are governed by the State law within the Professional Association of Engineers, section A, Industrial sector.

FRAMEWORK A2.b	**The programme trains students to the profession of (ISTAT codes - National Statistical Authority)**

1. Mechanic engineers - (2.2.1.1.1)

FRAMEWORK A3.a	**Knowledge required for the admission**

16/02/2017

KNOWLEDGE REQUIRED FOR THE ADMISSION

Access to the Degree Programme requires one of the following qualifications obtained in an Italian university, or another qualification obtained abroad and deemed as equivalent: Three-year University Degree or Diploma, Specialist Degree or Master's Degree, pursuant to MD 509/1999 or MD 270/2004, five-year Degree (previous to MD 509/1999).

The knowledge required for accessing this programme refer to an adequate mastery of general scientific methods and contents in basic disciplines (Mathematics, Information Technology, Statistics, Physics and Chemistry) and in engineering disciplines that are preparatory for the distinctive subjects of the degree programme.

Knowledge of the English language is also required at a suitable level to use texts of the sector and follow the classes and seminars provided in English, at least equivalent to the B2 level of the European common framework.

For applicants possessing an Italian study qualification, the curriculum requirements to access the programme are a minimum of 85 credits in the disciplinary scientific sectors (SDSs) as shown in Table 1 below, also referring to the minimum requirements set in Table 2. TABLE 1 - List of the SDSs for which a minimum of 85 credits are required

INF/01, ING-INF/04, ING-INF/05, ING-INF/07, MAT/02, MAT/03, MAT/05, MAT/06, MAT/07, MAT/08, MAT/09, SECS-S/02, CHIM/03, CHIM/07, FIS/01, FIS/03, ING-IND/02, ING-IND/03, ING-IND/04, ING-IND/05, ING-IND/06, ING-IND/07, ING-IND/08, ING-IND/09, ING-IND/10, ING-IND/11, ING-IND/12, ING-IND/13, ING-IND/14, ING-IND/15, ING-IND/16, ING-IND/17, ING-IND/21, ING-IND/22, ING-IND/23, ING-IND/27, ING-IND/31, ING-IND/32, ING-IND/33, L-LIN/12

TABLE 2 - Minimum number of credits (CFUs) required in the corresponding SDSs (Scientific Disciplinary Sectors)

INF/01, ING-INF/05, MAT/02, MAT/03, MAT/05, MAT/06, MAT/07, MAT/08, MAT/09, SECS-S/02, CHIM/03, CHIM/07, FIS/01, FIS/03: min 32 CFU

ING-INF/04, ING-IND/02, ING-IND/03, ING-IND/04, ING-IND/05, ING-IND/06, ING-IND/07, ING-IND/08, ING-IND/09, ING-IND/10, ING-IND/11, ING-IND/12, ING-IND/13, ING-IND/14, ING-IND/15, ING-IND/16, ING-IND/17, ING-IND/19, ING-IND/21, ING-IND/22, ING-IND/23, ING-IND/27, ING-IND/31, ING-IND/32, ING-IND/33: min 48 CFU

The curriculum requirements for the enrolment of candidates with a foreign qualification will be evaluated by a specific Commission who will analyse the study curriculum submitted.

PROCEDURE FOR ASSESSING THE REQUIRED KNOWLEDGE

A dedicated Commission checks that candidates possess the knowledge required for accessing the degree programme, as well as a proper level of such knowledge for the purpose of admission.

The knowledge resulting from the obtainment of a suitable qualification with the minimum score indicated in the Educational Regulation of the Degree Programme will be deemed adequate.

Through procedures provided for in the regulation of the Degree Programme and annual call for applications, the Commission checks that each single candidate possesses adequate language skills and quality skills.

FRAMEWORK A3.b	**Admission procedure**

22/03/2017

A dedicated Commission checks that each single candidate possesses high quality skills through an individual interview, in English, that may be done also via computer and/or by means of a written test, to evaluate the technical preparation and the motivation to choose the Master's Degree Programme.

For students possessing an Italian qualification, the curriculum requirements needed for the admission are checked through an assessment of the degree qualification and the possession of the university credits required.

For students possessing a qualification obtained abroad, the curriculum requirements needed for the admission are checked by a dedicated Commission in charge of assessing the degree qualification submitted by the candidate.
Candidates with an Italian qualification are considered as possessing the proper knowledge resulting from the obtainment of a suitable qualification with minimum score of 95/110.
Candidates with a foreign qualification are considered as possessing the proper knowledge resulting from the obtainment of a suitable qualification with minimum score of 95/110 or anyway not lower than 86% of the maximum score available.
In the event of study programmes not perfectly matching the requested requirements, for both Italian and foreign students, the Commission suggests curricular integrations through an additional programme. The programme shall be completed before the individual interview.
Through procedures provided for in the Degree Programme regulation and annual call for applications, the Commission checks that each single candidate possesses adequate language skills and quality skills by examining the certificates submitted or through other means that may be deemed suitable.

FRAMEWORK A4.a	**Specific training objectives of the Programme and training programme description**

16/02/2017

The Advanced Automotive Engineering Master's Degree Programme is aimed at providing the knowledge and the skills relating to the design of high-performance and racing motor vehicles and motor cycles, focusing on the development, integration and production of their main systems such as the powertrain and the chassis.
Graduates in Advanced Automotive Engineering shall possess the following skills:
- interpret and model the main design aspects relative to components, machines, complex mechanic and electric systems that are typical of modern vehicles, starting from a deep knowledge of the theoretical and scientific aspects of mathematics and the other basic sciences, and by means of an interdisciplinary approach;
- identify, formulate and resolve complex engineering issues requiring high-level theoretical and experimental knowledge and skills, by using the most modern computer-based tools;
- work in a collaborative way in multidisciplinary groups to ideate, plan, design and manage complex and/or innovative systems, processes and services relating to vehicle engineering, by applying knowledge and skills that are typical of mechanic, electronic, electric and material engineering;

STUDY PROGRAMME STRUCTURE

Students attending the Master's Degree Programme in Advanced Automotive Engineering already have proper basic knowledge that are typical of Mechanic Engineering and have the opportunity, in the initial phase of the study programme, to gain further skills in the field of Materials and Innovation Technologies, Engines, Electric and Hybrid Powertrain systems, Aerodynamics, Vehicle Mechanics and Dynamics, Structural Design of engines and chassis, Production Systems in the automotive field. After the first phase, students complete their preparation by vertically delve into the disciplines relating to Electric Machines, Electronics and Controls, with the purpose of providing a state-of-the-art training on electric/hybrid powertrain and on checks of high-performance modern vehicles. Such knowledge is enriched by learning and applying computer assisted design tools and virtual prototyping tools in the structural (FEM), fluid-dynamic (CFD) and design (CAD) fields, as well as by using highly specialised research and experimentation laboratories already shared with the companies, and industrial laboratories made available by the same companies that are involved in the educational project. Given the obligation for students to participate in training internships in companies or industrial research laboratories, the programme is structured as to allow for the application of an educational approach based on a learning by doing approach, further enhanced by the opportunity to choose curriculum activities within the Formula SAE teams, which have been available for a long time at the partner universities.

The training programme provided by the Study Programme is conceived as the development of hierarchical learning areas starting from a common one, and on their subsequent declination in specialist areas that are progressively covered more deeply thanks to a half-year term offered in multiple specialised universities, as described below. At the end of the training programme, the skills acquired are summarised in a semester that entirely focuses on carrying out professional design activities needed to progressively enter the job market.

CHANGES IN THE STUDY PROGRAMMES BASED ON THE CURRICULA AVAILABLE TO STUDENTS

The training programme provides for a period of time shared among all students, organised in order to provide them the basic skills required to understand the principles of high-performance vehicle design, during an initial learning stage. The programme offers training on skills relating to the design setting of the vehicle lay-out, with the production processes required for the manufacturing and assembly of the single components, by choosing and using the materials of greatest interest for the sector of high-performance vehicles, along with the main aspects connected with the mechanical effects taking place on systems and components.

Later, the study programme is divided into different curricula, in order to make the study programmes that students choose more specialised, based on the instructions provided by the parties involved, at the same time maintaining a global overview on the vehicle system. Curricula are connected with the development of the following specialist learning areas.

A second learning area deals with the powertrain. The programme is aimed at providing the skills, methods and tools for studying, designing and controlling powertrain systems, both endothermal and electric and hybrid, focusing on how to maximise their performance, as well as control ad solve environmental and energy issues. The programme is then structured as to enhance the aspects that are directly linked to both powertrain design and optimisation, and propulsion system control.

A further learning area is aimed at providing skills, methods and tools for studying, designing and testing the chassis system and the architecture of high-performance and racing vehicles. Such area is organised as to cover the aspects related to the design and production of standard vehicle systems on one side, and to develop topics that are mainly connected with the use of special materials and solutions for the racing sector on the other, also taking into account the highly experimental nature of the development activities and the focus on aerodynamic and performance aspects in such field.

A specific learning area is connected with the motor vehicle sector. It is aimed at providing skills, methods and tools for designing, developing and testing the engine and structure/chassis of high-tech standard and racing motor vehicles. Therefore it combines some of the training activities described in the previous sections, by offering a view that applies to the specific features of the motor vehicle.

The last specialist learning area relates to the specific topic of high-performance vehicle manufacturing. Here is were skills, methods and tools for planning, developing, controlling and managing automotive production systems are provided. The main areas of knowledge covered by the teachings are as follows: process engineering, industrial system design, production management and optimisation, automation technologies and solutions, digital technologies of the factory 4.0 and quality control process management.

All specialist learning areas that are organised in curricula end into a summary learning area that is aimed at providing methods, techniques and strategies useful to apply the skills and the tools acquired during the study programme, also through important practical experience to be carried out in the companies of the vehicle chain, as well as in the most advanced university and industrial research laboratories. More specifically, practical experience is offered in connection with the realisation on an important design or experimental project that will be presented in the final thesis. Such learning area is also aimed at offering students the opportunity to assess their own self-management and planning skills in scientific or industrial projects.

FRAMEWORK A4.b.1	**Knowledge and understanding, and Ability to apply knowledge and understanding: Summary**

KNOWLEDGE AND UNDERSTANDING

DISTINCTIVE ENGINEERING SUBJECTS

Master graduates in Advanced Automotive Engineering develop highly specific skills in motor and vehicle engineering that may be used in various disciplines such as engines, vehicle mechanics and dynamics, structural design of the chassis and engine, aerodynamics and design methods, and automotive production systems. To this purpose, students acquire skills that are essential when dealing with engineering complex issues, or looking for original and highly innovative solutions in advanced research contexts or in automotive top sectors, such as sports racing. Technical training is backed by purely practical activities carried out in experimental, numeric calculation and simulation laboratories (in the structural, fluid-dynamics and production field). RELATED AND INTEGRATING ENGINEERING SUBJECTS

Master graduates in Advanced Automotive Engineering consolidate the engineering knowledge acquired during their previous studies by exploring issues specifically relating to sectors like automated controls, electronics and electric cars, and may develop high-level specific skills in vehicle engineering. Students also have the opportunity to complete their training by expanding their knowledge of themes relating to various engine types, including the most innovative ones, and to gain the essential knowledge when dealing with application fields of both road and racing motor vehicles and vehicles.

KNOWLEDGE AND UNDERSTANDING VERIFICATION PROCEDURES

During the training programme, the achievement of training objectives relating to the knowledge and the understanding of engineering subjects is checked by offering workshops and specific industrial examples to students, aimed at getting them involved and allow for the assessment and self-assessment of the deep understanding of the issues that are dealt with. At the end of each course, students take a final examination, which may include both written and oral tests, to prove the quality of their individual knowledge and level of understanding

Knowledge and understanding

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Applying knowledge and understanding

APPLYING KNOWLEDGE AND UNDERSTANDING DISTINCTIVE ENGINEERING SUBJECTS

Master graduates in Advanced Automotive Engineering acquire the ability to face and solve issues in the field of Mechanical Engineering in general and the vehicle sector in particular. Because of the high complexity and interdisciplinary feature of the issues being dealt with, graduates must develop a strong vocation for technological innovation, applied research, the use of design techniques and calculation analysis, and teamwork.

Graduates are required to get the skills to critically analyse the technical and legislative evolution of the specific sector, in particular by evaluating the problems related to the use of innovative materials and technologies, the integration of mechanical electric and electronic systems, the management of experimental methods and the experiment design. The requirements described above are a key element of the professional success, both for graduates in charge of the design or production of road vehicles or motor vehicles, by virtue of the continuous drive towards the introduction of new technologies, materials and solutions with a low environmental impact, and for graduates who have to deal with the field of sports competitions, where the exacerbated technological content must combine with the extremely reduced times of intervention and response.

RELATED AND INTEGRATING ENGINEERING SUBJECTS

Master graduates in Advanced Automotive Engineering are able to apply their knowledge to the fields of design, simulation, system control techniques, choice of materials, experimentation, to sectors featuring a high degree of complexity and interdisciplinary issues, such as the high-performance automotive one.

HOW THE ABILITY TO APPLY KNOWLEDGE AND UNDERSTANDING IS VERIFIED

The achievement of training objectives relating to the knowledge and the understanding of engineering subjects is checked during the training programme by offering guided workshops and independent practice the students attending the course, for the assessment and self-assessment of their ability to apply the acquired knowledge, and by providing for a final test at the end of each course, which may include written and oral tests, and assessments on the activity of developing projects and/or prototypes also designed by a team of students (Working Project), provided that the specific contribution of each single student can be identified.

Principles of high-performance and racing vehicles

Knowledge and understanding

Knowledge and understanding of the engineering principles required to design/manufacture high-performance and racing motor vehicles and motor cycles. Such area is common to all the curricula offered. The expected learning results relate to the knowledge and understanding of the following topics on the vehicle sector and specifically refer to high-performance and racing vehicles:

- Production technologies and processes (manufacturing, assembly, checks)
- Plastic, metal and composite materials, described based on their functional performance and production processes
- NVH (Noise, Vibrations, Harshness) of units and mechanic components

-Design setting and vehicle lay-out
The expected learning results are achieved through the teachings indicated below, which include classroom lessons and practical exercises in computer and/or experimental laboratories.
The expected learning results are assessed by the professors at the end of each course, by means of oral and/or written tests. During the courses, students are offered the opportunity to self-assess their learning process, even by means of partial assessments.

Applying knowledge and understanding

Applying the acquired knowledge to the design process of high-performance and racing vehicle units and components, based on the specific design requirements:
- Choice, selection and use of the technologies and the processes needed for production (manufacturing, assembly, checks)
- Choice, selection and use of the main materials in the automotive sector
- Dimensioning based on the NHV (Noise, Vibrations, Harshness) behaviour
- Choice, definition and design of vehicle lay-out
The expected learning results are achieved through the teachings indicated below, which include classroom lessons and practical exercises in computer and/or experimental laboratories.
The expected learning results are assessed by the professors at the end of each course, through the assessment of designs and/or prototypes, even developed in a team (Working Project). During the courses, students are offered the opportunity to self-assess their learning process, by independently doing exercises assigned to them.

Knowledge and skills are achieved and assessed in the following training activities:
View Courses
Close Courses
Manufacturing and Assembly Technologies/Science and Technology of Metallic and Composite Materials url
Mechanical Vibrations url
Vehicle Conceptual Design url

Design and production of advanced powertrain systems

Knowledge and understanding

The expected learning results relate to the knowledge and the understanding of the engineering principles required for the design of endothermal, electric and hybrid propulsion systems, focusing on their optimisation, control and solution of environmental and energy issues. Courses are given at the universities of Modena and Bologna with a deeper focus on the propulsion system design and optimisation (Modena) or control (Bologna). The learning results
specifically refer to the following topics:
- Principles and foundations of internal combustion engines
- Advanced combustion systems
- Design and production of engine components and powertrain systems
- Design and production of high-performance motor propulsion systems
- Modelling and control of internal combustion motors and hybrid propulsion systems
- Powertrain testing, calibration and homologation
- Design and control of mechanical transmissions
- Electronic systems and automated controls
- Engines and propulsion electric systems
- Energy storage and conversion systems
The expected learning results are achieved through the teachings indicated below, which include classroom lessons and practical exercises in computer and/or experimental laboratories:
Modena
- Internal combustion engines
- Engine Components Design and Manufacturing/Automotive Computer Aided Design CAD
- Electric Drives/Electric Propulsion Systems
- Design and modelling of high performance combustion systems
- Mechanical transmissions/Automated controls
- Electromechanical Energy Storage and Conversion

Bologna
- Powertrain Design and Manufacturing
- Electronics systems/Automated controls
- Electric Drives/Internal Combustion Engines
- Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems
- Advanced Combustion Systems/Electric Propulsion Systems
- Electromechanical Energy Storage and Conversion
- Powertrain Testing, Calibration and Homologation

The expected learning results are assessed by the professors at the end of each course, by means of oral and/or written tests. During the courses, students are offered the opportunity to self-assess their learning process, evenby means of partial assessments.

Applying knowledge and understanding

Applying the acquired knowledge to the design process of advanced powertrain systems:
- Realisation of projects for manufacturing hybrid or electrical internal combustion propulsion systems
- Definition and realisation of tests for powertrain calibration and homologation
- Use of computer-aided design tools
- Choice, selection and use of energy storage and conversion

The expected learning results are achieved through the teachings indicated below, which include classroom lessons and practical exercises in computer and/or experimental laboratories:
Modena
- Internal combustion engines
- Engine Components Design and Manufacturing/Automotive Computer Aided Design CAD
- Electric Drives/Electric Propulsion Systems
- Design and modelling of high performance combustion systems
- Mechanical transmissions/Automated controls
- Electromechanical Energy Storage and Conversion

Bologna
- Powertrain Design and Manufacturing
- Electronics systems/Automated controls
- Electric Drives/Internal Combustion Engines
- Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems
- Advanced Combustion Systems/Electric Propulsion Systems
- Electromechanical Energy Storage and Conversion
- Powertrain Testing, Calibration and Homologation

The expected learning results are assessed by the professors at the end of each course, through the assessment of designs and/or prototypes, even developed in a team (Working Project). During the teachings, students are offered the opportunity to self-assess their learning process, by independently doing exercises assigned to them.

Knowledge and skills are achieved and assessed in the following training activities:
View Teachings
Close Teachings
Electronic Systems/Automated Controls url
Engine Components Design and Manufacturing/Automotive Computer Aided Design CAD url
Electric Drives/Electric Propulsion Systems url
Electric Drives/Internal Combustion Engines url
Internal Combustion Engines url
Powertrain Design and Manufacturing url
- Advanced Combustion Systems/Electric Propulsion Systems url
Mechanical transmissions/Automated Controls url
Design and Modelling of High Performance Combustion Systems url
Electromechanical Energy Storage and Conversion url
Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems url
Powertrain Testing, Calibration and Homologation url

Design and manufacturing of high-performance and racing vehicles

Knowledge and understanding

The expected learning results relate to the knowledge and understanding of the engineering principles required for the design of the cold part of high-performance (Modena) and racing (Parma) vehicles, and for the latter ones with a deeper focus on aerodynamics, on the use of lightweight materials and on carrying out testing activities. The learning results specifically refer to the following topics:
- Methods and tools for the CFD analysis relating to aerodynamics and thermal aspects
- Methods and tools for the experimental analysis as regards aerodynamics
- Methods and tools for the FEM analysis of mechanical units and components (e.g.: chassis)
- Dynamic analysis of vehicles
- Dynamic testing of vehicles
- NHV testing analysis of vehicle units and components
- Chassis and bodywork design
- Computer Aided Design of vehicle units and components
- Automated controls
- Hydraulic and pneumatic systems for the automotive sector
- Lightweight and composite materials

The expected learning results are achieved through the teachings indicated below, which include classroom lessons and practical exercises in computer and/or experimental laboratories:
Modena/Parma
- CFD fundamentals and aerodynamics
- FEM fundamentals and chassis design
- Vehicle dynamics
- Automotive Computer Aided Design CAD

Modena
- Vehicle NVH testing
- Automotive Electronics systems
- Automated controls
- Automotive fluid power systems

Parma
- Experimental aerodynamics
- Chassis and bodywork design
- Dynamic testing of vehicles
- Lightweight Materials and Composites

The expected learning results are assessed by the professors at the end of each course, by means of oral and/or written tests. During the courses, students are offered the opportunity to self-assess their learning process, even by means of partial assessments.

Applying knowledge and understanding

Applying the acquired knowledge to the design process of advanced powertrain systems:
- Realisation of manufacturing projects of systems for the cold parts of vehicles (frame, chassis, bodywork)
- Definition and realisation of tests for dynamic, aerodynamic and structural optimisation of vehicles
- Use of computer-aided design tools
- Choice and selection of pneumatic and hydraulic systems
- Choice, selection and use of lightweight materials

The expected learning results are achieved through the teachings indicated below, which include classroom lessons and practical exercises in computer and/or experimental laboratories:
Modena/Parma
- CFD fundamentals and aerodynamics
- FEM fundamentals and chassis design
- Vehicle dynamics
- Automotive Computer Aided Design CAD

Modena
- Vehicle NVH testing
- Automotive Electronics systems
- Automated controls
- Automotive fluid power systems

Parma
- Experimental aerodynamics
- Chassis and bodywork design
- Dynamic testing of vehicles
- Lightweight Materials and Composites
The expected learning results are assessed by the professors at the end of each course, through the assessment of designs and/or prototypes, even developed in a team (Working Project). During the teachings, students are offered the opportunity to self-assess their learning process, by independently doing exercises assigned to them.

Knowledge and skills are achieved and assessed in the following training activities:
View Teachings
Close Teachings
Automotive Computer Aided Design CAD url
CFD Fundamentals and Aerodynamics url
FEM Fundamentals and Chassis Design url
Vehicle Dynamics url
Automated Controls url
Automotive Electronics Systems url
Automotive fluid power systems url
Chassis and bodywork design url
Dynamic testing of vehicles url
Experimental aerodynamics url
Lightweight Materials and Composites url
Vehicle NVH Testing url

Design and manufacturing of high-performance and racing motor vehicles

Knowledge and understanding

The expected learning results relate to the knowledge and understanding of the engineering principles required for the design, development and testing of the engine and structure/chassis of high-tech mass-production and racing motor vehicles. Therefore, it combines some of the knowledge provided in the design and manufacturing areas of advanced powertrain systems, as well as design and manufacturing of high-performance and racing vehicles, offering an approach applied to the motor vehicle specific features. The learning results specifically refer to the following topics:
- Principles and fundamentals of internal combustion engines
- Engines and propulsion electric systems
- Electronic systems and automated controls
- Powertrain testing, calibration and homologation
- Chassis and bodywork design
- Vehicle virtual design
- Dynamic analysis of motor vehicles
The expected learning results are achieved through the teachings indicated below, which include classroom lessons and practical exercises in computer and/or experimental laboratories:
- Powertrain Design and Manufacturing
- Electronics systems/Automated controls
- Electric Drives/Internal Combustion Engines
- Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems
- Motorcycle Vehicle Dynamics
- Chassis and Bodywork Design and Manufacturing/Vehicle virtual design
- Powertrain Testing, Calibration and Homologation
The expected learning results are assessed by the professors at the end of each course, by means of oral and/or written tests. During the courses, students are offered the opportunity to self-assess their learning process, even by means of partial assessments.

Applying knowledge and understanding

Applying the acquired knowledge to the design process of high-performance and racing motor vehicles:

- Realisation of manufacturing projects of systems for the cold part of motor vehicles
- Realisation of projects for manufacturing hybrid or electrical internal combustion propulsion systems
- Use of computer-aided design tools
- Definition and realisation of tests for powertrain calibration and homologation

The expected learning results are achieved through the teachings indicated below, which include classroom lessons and practical exercises in computer and/or experimental laboratories:

- Powertrain Design and Manufacturing
- Electronics systems/Automated controls
- Electric Drives/Internal Combustion Engines
- Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems
- Motorcycle Vehicle Dynamics
- Chassis and Bodywork Design and Manufacturing/Vehicle virtual design
- Powertrain Testing, Calibration and Homologation

The expected learning results are assessed by the professors at the end of each course, through the assessment of designs and/or prototypes, even developed in a team (Working Project). During the teachings, students are offered the opportunity to self-assess their learning process, by independently doing exercises assigned to them.

Knowledge and skills are achieved and assessed in the following training activities:

View Teachings

Close Teachings

Electronics Systems/Automated Controls url

Electric Drives/Internal Combustion Engines url

Powertrain Design and Manufacturing url

Chassis and Body Design and Manufacturing/Vehicle Virtual Design url

Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems url

Powertrain Testing, Calibration and Homologation url

Motorcycle Vehicle Dynamics url

Manufacturing of high-performance vehicles

Knowledge and understanding

The expected learning results relate to the knowledge and understanding of the engineering principles required for the design, development, testing and management of production systems in the automotive sector. The main areas of knowledge covered by the teachings are as follows: process engineering, industrial system design, production management and optimisation, automation technologies and solutions, digital technologies of the factory 4.0 and quality control process management. The learning results specifically refer to the following topics:

- Principles and fundamentals of internal combustion engines
- Engines and propulsion electric systems
- Electronic systems and automated controls
- Design of industrial systems for production (manufacturing, assembly, checks)
- Automated and robotic production systems
- Control and programming of automated and robotic production systems
- Supply chain management

The expected learning results are achieved through the teachings indicated below, which include classroom lessons and practical exercises in computer and/or experimental laboratories:

- Powertrain Design and Manufacturing
- Electronics systems/Automated controls
- Electric Drives/Internal Combustion Engines
- Industrial Plant Design

- Industrial Robotics
- Algorithms and systems for big data processing
- Operations & Supply chain design and management/Automotive Manufacturing and Assembly Systems
The expected learning results are assessed by the professors at the end of each course, by means of oral and/or written tests. During the courses, students are offered the opportunity to self-assess their learning process, even by means of partial tests.

Applying knowledge and understanding

Applying the acquired knowledge to the design process of high-performance vehicles:
- Realisation of projects for manufacturing hybrid or electrical internal combustion propulsion systems
- Setting automated and robotic industrial system projects
- Operating management of automated and robotic industrial manufacturing systems (manufacturing, assembly, control).
The expected learning results are achieved through the teachings indicated below and including classroom lessons and practical exercises in computer and/or experimental laboratories:
- Powertrain Design and Manufacturing
- Electronics systems/Automated controls
- Electric Drives/Internal Combustion Engines
- Industrial Plant Design
- Industrial Robotics
- Algorithms and systems for big data processing
- Operations & Supply chain design and management/Automotive Manufacturing and Assembly Systems
The expected learning results are assessed by the professors at the end of each course, through the assessment of designs and/or prototypes, even developed in a team (Working Project). During the teachings, students are offered the opportunity to self-assess their learning process, by independently doing exercises assigned to them.

Knowledge and skills are achieved and assessed in the following training activities:
View Teachings
Close Teachings
Electronics Systems/Automated Controls url
Electric Drives/Internal Combustion Engines url
Powertrain Design and Manufacturing url
Operations & Supply Chain Design and Management/Automotive Manufacturing and Assembly Systems url
Industrial Plant Design url
Industrial Robotics url
Algorithms and Systems for Big Data Processing url

Project summary

Knowledge and understanding

The expected learning results relate to the knowledge and understanding of the synthesis of multidisciplinary skills in terms of high-performance and racing vehicle manufacturing design. Its purpose is to provide technical methodologies and strategies for the synergic application of the skills and tools learned during the development of the final thesis project. It includes the following training activities:
- Educational activities in learning by doing mode carried out within the Formula SAE educational project, for example.
- Internship and Thesis. Thesis project development carried out in an industrial environment through an internship experience in a company.
- Thesis project development. Independent development of the thesis project, under the supervision of a university tutor. The expected learning results are assessed by the professors and tutors during the activity performance and are subject to a final evaluation. Students are offered the opportunity to self-assess their learning process, even by means of project partial reviews.

Applying knowledge and understanding

Applying the knowledge acquired through laboratory and/or industrial testing of design methods, techniques and tools, carried out in direct contact with experts and real dynamics, and by directly assessing ones' own self-management and programming skills:
- Setting up manufacturing projects
- Activity planning
- Activity management
- Verification and check of the results achieved
It includes the following training activities:
- Educational activities in learning by doing mode carried out within the Formula SAE educational project, for example.
- Internship and Thesis. Thesis project development carried out in an industrial environment through an internship experience in a company.
- Thesis project development. Independent development of the thesis project, under the supervision of a university tutor. The expected learning results are assessed by the professors and tutors during the activity performance and are subject to a final evaluation, through the assessment of any projects and/or prototypes, even developed in a team (Working Project).

Knowledge and skills are achieved and assessed in the following training activities:
View Courses Close
CoursesFinal
Examination url Lab
SAE Formula url
Traineeship url
Traineeship url

FRAMEWORK A4.c	**Independent judgement** **Communication skills** **Learning skills**

Independent judgement

Master graduates in Advanced Automotive Engineering are able to critically deal with issues that are typical of Mechanical Engineering but are specifically applied to vehicles. Such issues are made extremely complex by the temporary presence of topics relating to other engineering sectors, such as controls and electronics, electric drives, material science.
At the end of the training programme, graduates are able to:
- identify and collect the data required to deal with the issues by means of bibliographic researches, use of data banks and other sources of information;
- ideate and directly carry out analytical surveys by using theoretical models, computer virtual prototypes and experimental measures;
- make a critical analysis of the data available and results achieved, and draw the appropriate conclusions;
- assess the applicability of innovative technologies in real time by inserting them into the specific context being analysed;
- carry out activities (measures, tests, computer simulations, etc.) and promote evaluations also by working in team.
- think and make independent evaluations on social and ethical themes, specifically referring to environmental sustainability and the diffusion of a technical and scientific culture.
The modes and educational tools used to achieve the expected results provide for the production and evaluation of project works and technical and/or scientific reports aimed at developing unique ideas, starting from the analysis of state-of-the-art scenarios, to be developed in a team or independently.
In addition, some laboratories included in the Degree Programme courses offer and evaluate independent testing activities (learning by doing) aimed at validating projects, manufacturing unique prototypes or understanding physical phenomena of engineering interest.

Ultimately, the active participation in meetings with leading representatives of the world of research and industry, even organised within seminars, conferences, and business visits, is encouraged in order to ensure the direct and independent exchange with the working environment.

Communication skills

The Master's Degree in Advanced Automotive Engineering provides students with the communication skills used to describe engineering issues, perform team work, and report to third parties the results of research and working activities in general. Learning such communication skills is an integral part of the study programme: useful tools for this purpose are reporting to peer students and professors the results achieved during practical exercises and laboratory activities, carried out individually or in team, preparing the thesis projects and drawing up technical reports on the activities carried out, taking oral assessments during examinations, participating in team work according to a learning by doing approach, and developing multidisciplinary engineering projects.

Any internship in companies of the automotive supply chain, along with any activity carried out in both industrial and university international research laboratories is a further testing ground that is useful to check and encourage communication and speaking skills in students. Ultimately, presenting the results achieved during the thesis is the perfect opportunity for students to test their communication skills acquired, which are an integral part of the assessment when the final degree score is assigned to them.

Graduates must prove that they master the English language.

Learning skills

The training programme of the Master's degree in Advanced Automotive Engineering, highly multidisciplinary and specialist at the same time, allows students to develop and enhance the learning skills they have acquired during their previous study programme.

In the working environments after graduating, students will be able to independently deal with analysing highly specialised engineering issues in the vehicle sector and its supply chain.

The training activities of the study programme are aimed not only at providing detailed information and state-of-the-art tools for solving technical issues that are peculiar or Vehicle Engineering, but also and mainly a state of mind focused on innovation, on the acquisition of new methodologies, and on the ability to strictly deal with engineering problems that are not necessarily the same or similar to those dealt with during the study period. Such skill offers graduates an adequate base for technical and technological challenges that they will have to deal with during their working career, including any post-degree training programmes (PhD, Master).

The learning skill is encouraged during the study programme through project and laboratory activities, in which students are encouraged to search for complementary information on technical magazines, texts, databases; preparing the thesis is ultimately the summary and evaluation of such skills, as students are required to deal with highly innovative applied research themes.

FRAMEWORK A5.a	**The final examination**

25/01/2017

The final examination is open to the audience and consists of the preparation and discussion of a written thesis, which students draw up in a unique way under the supervision of a tutoring professor. More specifically, it may include:

- a presentation and discussion of the activity carried out in companies or external entities, identified based on specific agreements, or in a research laboratory of the University or other public or private research entities, under the supervision of a professor, and when appropriate, of a reference person suggested by the companies or external entities;
- a presentation and discussion of an original project, generally including an experimental part and a laboratory part, developed under the supervision of a tutoring professor.

The thesis shall be drawn up in full and prove that the candidate masters the topics dealt with and the theoretical and technical tools used. The work shall be carried out with an adequate level of independence and critical analysis, and shall be presented and discussed by the candidate by proving adequate communication skills.

FRAMEWORK A5.b	**Final examination procedure**

15/02/2017

Students may choose to prepare the degree thesis in a company or in research laboratories of the departments involved, even associating the activities aimed at drawing up the thesis, or at making an internship or project activity. The procedures for activating internships or project activities are set in the education regulation.

Preparing their thesis during an internship in a company is an important opportunity for students. Companies offer several internship opportunities during the thesis period, and many of them become a real employment.

The final examination consists of the presentation of the written paper and the public discussion of the degree thesis. The thesis must be drawn up in English.

The thesis is presented and discussed in English in front of a dedicated commission. Graduating students shall prove that they have acquired independent working skills, master themes dealt with, are able to convey its contents in a synthetic way, they can hold a discussion.

The degree commission is in charge of assigning the final score, including the possible honour, by taking into account the overall average of the exams on a 110 basis. A maximum score as set by the education regulation may be added to the average, by taking into account:

- the evaluation of the project carried out for the thesis (commitment, independence, methodology, relevance of the results achieved, etc.);
- the presentation of the thesis (reporting clarity, etc.);
- the excellence of the study programme (for instance, the number of honours awarded, the experience in the university and research centres abroad, any extracurricular activity or student projects, etc.).

If the thesis possesses all the requirements, it may unanimously be awarded the right of publication only if the final mark is one hundred and ten cum laude and the thesis complies with the requirements.

FRAMEWORK B1	Training programme description (Education Regulation of the Programme)

Pdf attached: view
Pdf description: Training programme description

FRAMEWORK B2.a	Study Programme Calendar and training activity schedule

http://www.ingmo.unimore.it/site/home/didattica/orario-delle-lezioni.html

FRAMEWORK B2.b	Exam timetable

https://www.esse3.unimore.it/Guide/PaginaListaAppelli.do

FRAMEWORK B2.c	Session timetable for the Final Examination

http://www.ingmo.unimore.it/site/home/didattica/appelli-di-esame-e-di-laurea/appelli-di-laurea.html

FRAMEWORK B3	Course professors

The computer connections with the pages of the university website dedicated to such information are ensured.

No.	Areas	Year of study	Teaching	Last name First name	Pos.	Credits	Hours	Contact teacher
1.	ING-INF/04	Year of study 1	Automated Controls *(Electronics Systems/Automated Controls module)* link	ROSSI CARLO		6	60	

		1	*(Engine Components Design and Manufacturing/Automotive Computer Aided Design CAD module)* link	LEALI FRANCESCO	PA	6	60
3.	ING-IND/10	Year of study 1	CFD Fundamentals and Aerodynamics link	STALIO ENRICO	RU	9	90
4.	ING-IND/32	Year of study 1	Electric Drives *(Electric Drives/Internal Combustion Engines module)* link	ROSSI CLAUDIO		6	60
5.	ING-IND/32	Year of study 1	Electric Drives *(Electric Drives/Electric Propulsion Systems module)* link	IMMOVILLI FABIO	RD	6	60
6.	ING-IND/32	Year of study 1	Electric Propulsion Systems *(Electric Drives/Electric Propulsion Systems module)* link	FRANCESCHINI GIOVANNI	PO	6	60
7.	ING-INF/01	Year of study 1	Electronics Systems *(Electronics Systems/Automatic Controls module)* link	DOCENTE FITTIZIO		6	60
8.	ING-IND/14	Year of study 1	Engine Components Design and Manufacturing *(Engine Components Design and Manufacturing/Automotive Computer Aided Design CAD module)* link	GIACOPINI MATTEO	PA	6	60
9.	ING-IND/14	Year of study 1	FEM Fundamentals and Chassis Design link	BERTOCCHI ENRICO	RD	9	90
10.	ING-IND/08	Year of study 1	Internal Combustion Engines link	MATTARELLI ENRICO	PA	6	60
11.	ING-IND/08	Year of study 1	Internal Combustion Engines *(Electric Drives/Internal Combustion Engines module)* link	RAVAGLIOLI VITTORIO	RD	6	60
12.	ING-IND/16	Year of study 1	Manufacturing and Assembly Technologies *(Manufacturing and Assembly Technologies/Science and Technology of Metallic and Composite Materials module)* link	BASSOLI ELENA	PA	6	60
13.	ING-IND/13	Year of study 1	Mechanical Vibrations link	PELLICANO FRANCESCO	PA	6	60

Automotive Computer Aided Design CAD2 ING-IND/15 Year of study

14.	ING-IND/14	Year of study 1	Powertrain Design and Manufacturing link	CROCCOLO DARIO		6	60
15.	ING-IND/21	Year of study 1	Science and Technology of Metallic and Composite Materials *(Manufacturing and Assembly Technologies/Science and Technology of Metallic and Composite Materials module)* link	VERONESI PAOLO	PA	6	30
16.	ING-IND/21	Year of study 1	Science and Technology of Metallic and Composite Materials *(Manufacturing and Assembly Technologies/Science and Technology of Metallic and Composite Materials module)* link	GIOVANARDI ROBERTO	PA	6	30
17.	ING-IND/15	Year of study 1	Vehicle Conceptual Design link	LEALI FRANCESCO	PA	6	60
18.	ING-IND/13	Year of study 1	Vehicle Dynamics link	SORRENTINO SILVIO	PA	12	120
19.	ING-IND/16	Year of study 2	Additive Manufacturing of Automotive Components link	BASSOLI ELENA	PA	6	60
20.	ING-INF/04	Year of study 2	Automated Controls *(Mechanical transmissions/Automatic Controls module)* link	ZANASI ROBERTO	PO	6	60
21.	ING-IND/22	Year of study 2	Lightweight Materials and Composites link	BONDIOLI FEDERICA	PA	6	60
22.	ING-IND/13	Year of study 2	Mechanical transmissions *(Mechanical transmissions/Automated Controls module)* link	BARBIERI MARCO	RD	6	60
23.	ING-IND/08	Year of study 2	Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems link	CAVINA NICOLO'	PA	6	60
24.	ING-IND/13	Year of study 2	Motorcycle Vehicle Dynamics link	VERTECHY ROCCO	PA	6	60
25.	ING-IND/13 ING-IND/13	Year of study 2	Vehicle NVH Testing link	MUCCHI EMILIANO	RD	6	60

FRAMEWORK B4	**Classrooms**

Pdf attached: view

FRAMEWORK B4	**Laboratories and IT Classrooms**

Pdf attached: view

FRAMEWORK B4	**Study rooms**

Pdf attached: view

FRAMEWORK B4	**Libraries**

Pdf attached: view

14/02/2017

Each year, the Programme Coordination Committee will define the joint services among the Universities involved, based on what provided for in the agreement and with the company partnership.

More specifically, University and Department initiatives will be carried out, in common with the other Bachelor's and Master's Degree Programmes, such as:

a) meetings in schools with presentation of the training offer of the various Departments

b) meetings in schools with classes agreed with the School

c) meetings in Departments with presentation of the training offer of the Department involved

d) guidance classes in the various Departments

e) vocational internships for high-school students
f) meetings with the Delegates for the outgoing guidance of high-school students g) open Days dedicated to the presentation of Master's Degrees

FRAMEWORK B5	**In itinere guidance and tutoring**

09/03/2017

Each year, the Programme Coordination Committee will define the joint services among the Universities involved, based on what provided for in the agreement and with the company partnership.

More specifically, University and Department initiatives will be carried out, in common with the other Bachelor's and Master's Degree Programmes, such as:

a) front office during reception hours, available on the webpages of the Departments and/or Universities through tutor professors and the Education Coordination office

b) students' career monitoring via e-mail and phone contacts (this service is specifically aimed at monitoring students enrolled beyond the prescribed time for graduation, in order to try to understand the reasons why they are in such condition)

c) classroom presentation to first-year students of the education office activities (education coordination, education support, internship office)

d) classroom presentation to second-year students of the three-year degrees and to first-year students of the master's degrees of the study plan filling-out procedures (with dedicated tutoring professors)

e) performance of cross-cutting support activities dedicated to standard subjects, organised by the Education Coordination with Senior Students support to disabled and dyslexic students, through focused activities managed by the Education Coordination Office with tutoring professors and dedicated tools.

Link description: University webpage dedicated to Guidance
Link added: http://www.orientamento.unimore.it/site/home.html

FRAMEWORK B5	**Assistance for the participation in training periods abroad (internships and traineeships)**

14/02/2017

Each year, the Programme Coordination Committee will define the joint services among the Universities involved, based on what provided for in the agreement and with the company partnership.

More specifically, University and Department initiatives will be carried out, in common with the other Bachelor's and Master's Degree Programmes, such as:

a) classroom presentation to the third-year students of the three-year degrees and to master's degree students of the internship and traineeship application procedures.

b) front office during reception hours, available on the webpages of the Departments and/or Universities through the Internship Office.

c) contact maintenance and tracing of contacts with companies aimed at finding training and vocational internship projects to offer to students enrolled in the various degree programmes.

FRAMEWORK B5	**Contributions and agreements for students' international mobility**

This field shall report all the students' international mobility arrangements agreed with foreign Universities, except for the arrangements governing the structure of interuniversity programmes, which shall be noted down in the specific "Interuniversity programmes".

For each foreign University covered by an agreement, please include the arrangement governing the student mobility, among other things, and indicate whether a double or multiple qualification may be issued to students following their relevant mobility programme. If a double or multiple qualification is not provided for with the foreign University (for example, Erasmus mobility arrangements), please indicate "Italian only" to specify that students participating in the mobility programme will only obtain the standard qualification issued by their original university.

The study programmes issuing a double or multiple qualification with a foreign University are considered international pursuant to MD 1059/13.

Each year, the Programme Coordination Committee will define the joint services among the Universities involved, based on what provided for in the agreement and with the company partnership.

More specifically, University and Department initiatives will be carried out, in common with the other Bachelor's and Master's Degree Programmes, such as:

g) management of internships in companies and foreign universities: contacts and documentation management

b) assistance in filling-out the documents in the required language and or the extra documents required abroad

c) promotion and assistance in filling-out the request for the call for applications selection

No Universities

FRAMEWORK B5	**Work support**

08/03/2017

Each year, the Programme Coordination Committee will define the joint services among the Universities involved, based on what provided for in the agreement and with the company partnership.

More specifically, University and Department initiatives will be carried out, in common with the other Bachelor's and Master's Degree Programmes, such as:

a) front office during reception hours, available on the webpages of the Departments and/or Universities through Internship Offices b) participation in University Career Days

c) activation of post-degree vocational and training internships as first step to accessing the job market

d) availability to organise classroom meetings and seminars where directly requested by the companies and agreed with the professors

e) issuing of calls for applications, grants, courses and selections coming from the companies

FRAMEWORK B5	**Additional initiatives**

14/02/2017

Each year, the Programme Coordination Committee will define any initiative among the Universities involved, based on what provided for in the agreement and with the company partnership.

FRAMEWORK B6	**Students' comments**

15/02/2017

The programme is a new one. There are no available data.

FRAMEWORK B7	**Graduates opinions**

15/02/2017

The programme is a new one. There are no available data.

FRAMEWORK C1	**Entry, study programme and outgoing data**

15/02/2017

The programme is a new one. There are no available data.

FRAMEWORK C2	**External efficiency**

15/02/2017

The programme is a new one. There are no available data.

FRAMEWORK C3	**Comments of institutions and companies with internship / traineeship agreements, within or outside the study programme**

15/02/2017

The programme is a new one. There are no available data.

FRAMEWORK D1	**Organisational structure and responsibilities at University level**

14/02/2017

Reported below are the Unimore organisational structure and responsibilities, as administration university
Link added: http://www.presidioqualita.unimore.it/site/home/il-pqa/struttura-organizzativa-aq.html

FRAMEWORK D2	**QA organisation and responsibilities at Study Programme level**

14/02/2017

All Study programmes belonging to the Department of the administrative university of the programme refer to the Department QA Responsible and to the Department Quality Commission as regards the connection with the University Quality Presidium and the QA Coordination of the various study programmes.

The Programme Coordination Committee is responsible for defining the QA organisation and responsibilities at Study Programme level each year, consistently with the instructions of the Presidia of the Universities involved.

FRAMEWORK D3	**Work planning and initiative implementation deadlines**

20/02/2017

As a rule of thumb, the QA work group of the Study Programme matches the work group of the Review, in collaboration with the Coordination of the Study Programme.

The work planning and the deadline for the implementation of the initiatives aimed at verifying the transparency are reported in the document attached, together with the deadlines relating to the joint committee.

Pdf attached: view
Pdf description: Work planning and shared initiative implementation deadlines

FRAMEWORK D4	**Annual review**

FRAMEWORK D5	**Study Programme planning**

Pdf attached: view
Pdf description: Planning Document (Class LM-33)

FRAMEWORK D6	**Any other document deemed useful to motivate the activation of the Study Programme**

Degree Programme - General Information

University	University of MODENA and REGGIO EMILIA
Programme name (Italian)	Ingegneria del Veicolo ad Alte Prestazioni
Programme name (English)	Advanced Automotive Engineering
Class	LM-33 - Mechanic Engineering
Language	English
Degree Programme Website (if any)	http://www.ingmo.unimore.it/site/home/didattica/lauree-magistrali.html
Fees	http://www.unimore.it/ammissione/tasse.html
Degree Programme Type	a. Conventional

Interuniversity programmes

Please fill out this form only for interuniversity study programmes

In an "interuniversity" programme, the partner Universities sign an agreement aimed at directly governing the objectives and training activities of a single study programme, which is activated jointly by the Universities involved, and one of them (with shifts available) is in charge of the programme administration management. The partner Universities also agree on the teachings that each of them activates. A joint study qualification shall be issued to all students enrolled (even by means of a double parchment - double qualification).

An interuniversity programme may involve Italian universities only, or also Italian and foreign Universities. In the latter case, the study programme is classified as international pursuant to the MD 1059/13.

Study programmes fully provided by an Italian university, even under agreements with one or more foreign Universities that mainly govern students' international mobility programmes (normally in exchange mode) and provide for giving interested students also a study qualification issued by foreign Universities, are not interuniversity programmes. In this case, the relevant agreements shall not be reported here but in the "Contributions and agreements for students' international mobility" field of the framework B5 of the SUA-DP sheet instead.

As regards the interuniversity programmes, in this field please indicate the Universities involved alongside the agreements governing, among the other things, how the training activities of the programme are divided among them.

Any action in this field is considered a change to the study plan. If agreements not relating to interuniversity programmes have been entered in this field in the SUA-DP sheet for the A.Y. 14-15, such agreements must be moved to the "Contributions and agreements for students' international mobility" field of the framework B5. If no other changes are made to the study plan,

simply state in the “University’s Communications to the National University Committee” field that this is the only change to the plan made this year, to ensure that the plan is automatically approved by the National University Committee.

Partner universities	**University**	**agreement date**	**duration**	**provisional date**
	Università degli Studi di BOLOGNA	03/02/2017	3	
	Università degli Studi di FERRARA	03/02/2017	3	
	Università degli Studi di PARMA	03/02/2017	3	
Qualification type	Joint			

Professors of other universities

International programme: MD 987/2016

Università degli Studi di BOLOGNA	
CAVINA Nicolo	ING-IND/08
RAVAGLIOLI Vittorio	ING-IND/08
VERTECHY Rocco	ING-IND/13
Università degli Studi di FERRARA	
MUCCHI Emiliano	ING-IND/13
Università degli Studi di PARMA	
BONDIOLI Federica	ING-IND/22
FRANCESCHINI Giovanni	ING-IND/32

Contacts and Facilities

President (or Contact Person or Coordinator) of the Study Programme	PELLICANO Francesco
Collegiate Body for the management of the study programme	Study Programme Board
Reference educational department	'Enzo Ferrari' Engineering

Contact Professors

No.	LAST NAME	FIRST NAME	AREA	TITLE	WEIGH	SDS TYPE	Teaching assignment
1.	BASSOLI	Elena	ING-IND/16	AP	1	Distinctive	1. Manufacturing and Assembly Technologies 2. Additive Manufacturing of Automotive Components
2.	IMMOVILLI	Fabio	ING-IND/32	RD	1	Related	1. Electric Drives
3.	ZANASI	Roberto	ING-INF/04	PO	1	Related	1. Automated Controls
4.	BONDIOLI	Federica (University of Parma)	ING-IND/22	PA	1	Related	1. Lightweight Materials and Composites
5.	CAVINA	Nicolo (University of Bologna)	ING-IND/08	PA	1	Distinctive	1. Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems
6.	VERTECHY	Rocco (University of Bologna)	ING-IND/13	PA	1	Distinctive	1. Motorcycle Vehicle Dynamics
7.	FRANCESCHINI	Giovanni (University of Parma)	ING-IND/32	PO	1	Related	1. Electric Propulsion Systems
8.	MUCCHI	Emiliano (University of Ferrara)	ING-IND/13	RD	1	Distinctive	1. Vehicle NVH testing
9.	RAVAGLIOLI	Vittorio (University of Bologna)	ING-IND/08	RD	1	Distinctive	1. Internal Combustion Engines

teaching requirement (number and type) successfully verified!

teaching requirement (teaching assignment) successfully verified!

Students' Representatives

LAST NAME	FIRST NAME	EMAIL	PHONE
Bellucci	Andrea		

Bompani	Davide
Bursi	Edoardo
Ciancia	Antonio
Coelli	Daniele
Faenza	Francesco
Guerzoni	Andrea
Manfo Teboko	William
Papazzoni	Daniele
Rambaran	Dhansaw

QA managing team

LAST NAME	FIRST NAME
Bassoli	Elena
Borghi	Massimo
Melloni	Riccardo
Messori	Massimo
Sorrentino	Silvio
Zardin	Barbara

Tutor

LAST NAME	FIRST NAME	EMAIL
PELLICANO	Francesco	

Access planning

National planning (Art.1 Law 264/1999)	No
Local planning (Art.2 Law 264/1999)	Yes - Places: 120

Local planning requirements
Local planning was approved upon proposal of the reference structure of: 20/12/2016
- High specialisation laboratories available
- IT systems available

Programme locations

MD 987 12/12/2016 Annex A - teaching requirements

Programme location: Via Vivarelli, 10/1 41125 Modena - MODENA, ……	
Programme start date	18/09/2017
Expected students	120

Curricula available

Advanced Powertrain - Modena
Advanced Powertrain - Bologna
High Performance Car Design
Racing Car Design
Advanced Motorcycle Engineering
Advanced Sportscar Manufacturing

Further information

University internal code	
Maximum number of credits assigned	*MD 16/3/2007 Art 4 Note 1063 of 29/04/2011*
Programmes of the same class	• MECHATRONIC ENGINEERING *approved with M.D. of 05/05/2009* • Mechanic Engineering • Vehicle Engineering

Reference approval dates

Approval date of the educational structure	16/02/2017
Approval date of the Academic Senate/Board of Directors	22/02/2017
Date of the technical report made by the Board of Evaluation	24/01/2017
Date of consultation with local organisations representing production, services, and professions	04/10/2016 - 15/12/2016
Date of the favourable opinion by the Coordinating regional committee	22/12/2016

Date of the technical report made by the Board of Evaluation

The definition of the training project and its relevant documentation is commendable both in terms of the richness of information and its organisation.
Students clearly understand the name given to the programme.
The establishment since 2015 of an interuniversity board made of university delegates and representatives of the most important companies of the automotive sector, along with a specific study commissioned on the competitiveness of the automotive district suggest that the consultation with the involved parties was started on time and is effective to truly rousing the interest of the parties involved in the training project. It is worth noting that the role of the parties involved in this specific project has developed from being traditional suppliers of information/suggestions/advice to becoming co-designers of the training project.
The five professional profiles (programmes) defined in collaboration with the industrial partners are described in detail.
The same level of detail, clearness and specificity applies to the indications of the skills associated to each profile.
The specific training objectives are described in detail, as well as the verification methods and educational tools used. The knowledge required for accessing the programme are clearly defined.

The international opening by offering the study programme in English, the integration of a network of skills available in the region and the high level of specialisation, also achieved by defining curricula on the most innovative themes in the automotive sector, distinguish the offer from the other degrees that are currently already available at Unimore (LM-33 Vehicle Engineering and LM-33 Mechanic Engineering).
The Board also deems adequate the availability of structural resources (classrooms, laboratories, etc.), which are essential for the programme to run smoothly, mainly against the commitment of the industrial partners to make their own laboratories available both for the training and internship activities.
Compliance with the quantitative and qualitative teaching requirements is ensured.
The Board of Evaluation delivers a favourable opinion to the establishment of the Study Programme LM-33 Advanced Automotive Engineering.

Accreditation report of the Board of Evaluation

The complete report of the Board of Evaluation, essential for the accreditation procedure of the study programmes shall be entered in the appropriate field inside the SUA-CdS sheet named "Accreditation report of the Board of Evaluation" by the deadline of 31 March 2017 for the new courses and by the deadline of the SUA reporting for all other courses. The Board report may be drawn up by following the evaluation criteria summarised below and described in details in the ANVUR (Italian National Agency for the Evaluation of the University and Research Systems) guidelines for the initial accreditation of the new Study Programmes, available for consultation on the ANVUR website
Offline study programme guidelines
Online study programme guidelines

1. Study Programme planning/activation reasons
2. Analysis of the educational demand
3. Analysis of the skill profiles and expected learning results
4. Student's experience (Analysis of the modalities adopted to ensure that the running of training activities and Study Programme results are consistent with the objectives and are properly managed in accordance with the quality criteria with a strong commitment to the principle of collegiality by the teaching staff).
5. Resources available
6. Quality Assurance

Reasons for the establishment of multiple programmes in the class

The interuniversity international Degree Programme in Advanced Automotive Engineering is established in the LM-33 class in Mechanic Engineering, but is strongly focused on the creation of a professional profile able to design, develop and manufacture the main subsystems making up road vehicles and motor vehicles, with specific reference to the premium and motorsport market segments, and to develop and manage the relative technology and manufacturing processes. All the Universities involved in the project offer degree programmes of the same class, still with significantly different reference professional profiles:
- MECHANIC ENGINEERING at UNIBO, UNIFE, UNIPR, UNIMORE
- MECHATRONIC ENGINEERING at UNIMORE
- ENGINEERING OF PLANTS AND FOOD INDUSTRY EQUIPMENTS at UNIPR

On the other hand, for many years UNIMORE has been offering a master's degree programme in VEHICLE ENGINEERING aimed at providing the knowledge and skills relating to the design, manufacturing, management and use of mechanic components, complex mechanic machines and systems belonging to a wide spectrum of sectors that are distinctive of Vehicle Engineering, such as alternative endothermal engines, vehicles, motor vehicles and agricultural machinery, using the methods and techniques typical of Engineering. Even developing skills that cover and are common to multiple sectors of Mechanic Engineering, and therefore ensuring graduates the opportunity to find a suitable career option in a wide range of industrial sectors, the degree programme focuses on providing a specialised training that can be used immediately in vehicle manufacturing companies, including those specifically operating in the sports racing sector, which has always been the crown-jewel of the regional production system.

However, the Analysis project of the competitiveness of the Modena automotive district was presented at Modena Tech Hub in 2015: it had been commissioned to the AlixPartners company by Confindustria (Italian employers' federation) of Modena, Modena Chamber of Commerce, Fondazione Cassa di Risparmio of Modena, and Fondazione Democenter. The study project was carried out in three phases: identification of the automotive manufacturers' needs; analysis of the training offer and industrial structure; identification of the initiatives that should be promoted to fill any gaps and strengthen the competitiveness in the sector. The study has identified the need for highly qualified resources, definitely exceeding the offer guaranteed by the programme at the University of Modena and Reggio Emilia.

The subsequent exchange with the main companies operating in the manufacturing of road vehicles in the Region (Automobili Lamborghini Spa, Dallara Automobili SpA, Ducati Motor Holding Spa, FCA Group - Maserati e Alfa Romeo, Ferrari Spa, Magneti Marelli Spa, Scuderia Toro Rosso Spa), has clearly shown that a vehicle engineer must currently be able to deal every day with the challenges related to the evolution of the traditional vehicle in a high-tech complex system based on deep interconnections among mechanics, electronics, storage and energy conversion systems, materials and control.

As stated by the companies, the main asset of the professional profile is that it covers multiple disciplines. On the other hand, given the increasing complexity of new generation road vehicles, along with the consequent and progressive specialisation of the engineering functions, the companies have defined five specific and extremely vertical professional profiles.

Thanks to the contribution of Regione Emilia-Romagna and the coordination of the University of Modena and Reggio Emilia, the 4 Universities in the region (UNIBO, UNIFE, UNIMORE, UNIPR) have taken up the challenge and proposed a unique path aimed at widening and valuing the existing training offer, even at an international level.

The activation of an International Master's Degree in ADVANCED AUTOMOTIVE ENGINEERING was then proposed, the main features being as follows: the selection of the teachers, coming both from the university and the industry, through an international call for applications aimed at ensuring the best technical and scientific skills, as well as top education quality; the selection of students admitted to the degree programme as a consequence of a careful evaluation of their merits and a technical and motivational interview; the assignment of students, based on their ranking and the interests stated, to each of the six curricula in which the Degree Programme is organised, on the subjects approximately indicated as Chassis Design, Advanced PowerTrain, Motorsport Chassis, Advanced Motorcycle Engineering, Automotive Production Engineering; the courses fully provided in English and the extreme focus on theoretical and laboratory contents (at Universities and company laboratories of industrial partners), based on a Learning by Doing approach; the participation in compulsory internships at the industrial partners and the carrying out of thesis activities based on a Project Working mode at university and corporate research laboratories.

All these features make the proposed programme extremely original and clearly distinct from the existing offer.

Summary of the Coordinating Regional Committee's opinion

In the session of 22 December 2016, the Coordinating Regional Committee delivered its favourable opinion on the activation of the new study programme proposed by the University of Modena and Reggio Emilia.

Educational plan provided

	CUIN cohort		teaching	teaching sectors	Professor	professor's sector	No. of teaching hours
1	2017	171702255	**Automated Controls** (Electronics module Systems/Automated Controls) *half-year*	ING-INF/04	Carlo ROSSI *Senior Associate Professor at the University of BOLOGNA*	ING-INF/04	60
2	2017	171702257	**Automotive Computer Aided Design CAD** (Engine Components Design and Manufacturing/Automotive Computer Aided Design CAD module) *half-year*	ING-IND/15	Francesco LEALI Associate Professor *(L. 240/10) University of MODENA and REGGIO EMILIA*	ING-IND/15	60
3	2017	171702260	**CFD Fundamentals and Aerodynamics** *half-year*	ING-IND/10	Enrico STALIO *Senior Research Fellow at the University of MODENA and REGGIO EMILIA* **Contact professor**	ING-IND/10	90
4	2017	171702261	**Electric Drives** (Electric Drives/Electric Propulsion System module) *half-year*	ING-IND/32	Fabio IMMOVILLI *Researcher on a temporary contract (Art. 24 s.3-b L. 240/10) University of MODENA and REGGIO EMILIA*	ING-IND/32	60
5	2017	171702263	**Electric Drives** (Electric Drives/Internal Combustion Engine module) *half-year*	ING-IND/32	Claudio ROSSI *Associate Professor (L. 240/10) University of BOLOGNA* **Contact professor**	ING-IND/32	60
6	2017	171702265	**Electric Propulsion Systems** (Electric Drives/Electric Propulsion	ING-IND/32	Giovanni FRANCESCHINI	ING-IND/32	60

			System module) *half-year*		*1st level professor University of PARMA*			
7	2017	171702266	**Electronics Systems** (Electronics module Systems/Automatic Controls) *half-year*	ING-INF/01	Fittizio PROFESSOR			60
8	2017	171702267	**Engine Components Design and Manufacturing** (Engine Components Design and Manufacturing/Automotive Computer Aided Design CAD module) *half-year*	ING-IND/14	Matteo GIACOPINI *Associate Professor (L. 240/10) University of MODENA and REGGIO EMILIA*	ING-IND/14		60
9	2017	171702268	**FEM Fundamentals and Chassis Design** *half-year*	ING-IND/14	Enrico BERTOCCHI *Researcher on a temporary contract (Art. 24 s.3-b L. 240/10) University of MODENA and REGGIO EMILIA*	ING-IND/14		90
10	2017	171702269	**Internal Combustion Engines** (Electric Drives/Internal Combustion Engine module) *half-year*	ING-IND/08	**Contact professor** Vittorio RAVAGLIOLI *University of BOLOGNA*	ING-IND/08		60
11	2017	171702270	**Internal Combustion Engines** *half-year*	ING-IND/08	Enrico MATTARELLI *Senior Associate Professor at the University of MODENA and REGGIO EMILIA*	ING-IND/08		60
12	2017	171702271	**Manufacturing and Assembly Technologies** (Manufacturing and Assembly Technologies/Science and Technology of Metallic and Composite Material module) *half-year*	ING-IND/16	**Contact professor** Elena BASSOLI *Associate Professor (L. 240/10) University of MODENA and REGGIO EMILIA*	ING-IND/16		60

13	2017	171702273	**Mechanical Vibrations** *half-year*	ING-IND/13	Francesco PELLICANO *Senior Associate Professor at the University of MODENA and REGGIO EMILIA*	ING-IND/13	60
14	2017	171702274	**Powertrain Design and Manufacturing** *half-year*	ING-IND/14	Dario CROCCOLO *Full Professor (L. 240/10) University of BOLOGNA*	ING-IND/14	60
15	2017	171702275	**Science and Technology of Metallic and Composite Materials** (Manufacturing and Assembly Technologies/Science and Technology of Metallic and Composite Materials module) *half-year*	ING-IND/21	Roberto GIOVANARDI *Associate Professor (L. 240/10) University of MODENA and REGGIO EMILIA*	ING-IND/21	30
16	2017	171702275	**Science and Technology of Metallic and Composite Materials** (Manufacturing and Assembly Technologies/Science and Technology of Metallic and Composite Materials module) *half-year*	ING-IND/21	Paolo VERONESI *Associate Professor (L. 240/10 University of MODENA and REGGIO EMILIA*	ING-IND/22	30
17	2017	171702276	**Vehicle Conceptual Design** *half-year*	ING-IND/15	Francesco LEALI Associate Professor *(L.240/10 University of MODENA and REGGIO EMILIA*	ING-IND/15	60
18	2017	171702277	**Vehicle Dynamics** *half-year*	ING-IND/13	Silvio SORRENTINO *Associate Professor (L. 240/10) University of MODENA and REGGIO EMILIA*	ING-IND/13	120

total hours 1140

Scheduled educational plan

Curriculum: Advanced Powertrain - Modena

Distinctive activities	sector	CFU Ins	CFU Off	CFU Rad
Mechanic Engineering	ING-IND/16 Technologies and processing systems *Manufacturing and Assembly Technologies (1st year) - 6 CFUs - half-year* ING-IND/15 Drawing and industrial engineering methods *Automotive Computer Aided Design CAD (1st year) - 6 CFUs - half-year* *Vehicle Conceptual Design (1st year) - 6 CFUs - half-year* ING-IND/14 Mechanic design and car manufacturing *Engine Components Design and Manufacturing (1st year) - 6 CFUs - half-year* *Design and Modelling b (2nd year) - 6 CFUs - half-year* ING-IND/13 Machinery applied mechanics *Mechanical Vibrations (1st year) - 6 CFUs - half-year* *Mechanical transmissions (2nd year) - 6 CFUs - half-year* ING-IND/08 Fluid machinery *Internal Combustion Engines (1st year) - 6 CFUs - half-year* *Design and Modelling a (2nd year) - 6 CFUs - half-year* **Minimum of credits reserved to the university: - (minimum as per M.D. 45)**	54	54	48 - 66
Total distinctive activities			54	48 - 66

Related activities	sector	CFU Ins	CFU Off	CFU Rad
Related or integrating training activities	ING-IND/21 Metallurgy *Science and Technology of Metallic and Composite Materials (1st year) - 6 CFUs - half-year* ING-IND/32 Converters, machinery and electric drives *Electric Drives (1st year) - 6 CFUs - half-year* *Electric Propulsion Systems (1st year) - 6 CFUs - half-year* *Electromechanical Energy Storage and Conversion (2nd*	30	30	18 - 36 min 12

	year) - 6 CFUs - half-year		
	ING-INF/04 Automation		
	Automated Controls (2nd year) - 6 CFUs - half-year		
Total related activities		30	18 - 36

Other activities		**CFU**	**CFU Rad**
To be chosen by the student		12	12 - 12
For the final examination		12	12 - 12
	Additional language skills	-	0 - 6
Additional training activities	ITC skills	-	0 - 6
(Art. 10, paragraph 5, letter d)	Training and vocational internship programmes	12	6 - 12
	Additional knowledge useful for entering the job market	-	0 - 6
	Minimum credits that the university reserves to Activities Art. 10, paragraph 5, letter d		12
For internship programmes in companies, public or private institutions, professional		-	-
Total Other Activities		36	36 - 54

Total CFUs for obtaining the degree **120**

Total CFUs provided in the programme Advanced Powertrain - ***Modena:*** 120 102 - 156

Curriculum: Advanced Powertrain - Bologna

Distinctive activities	**sector**	**CFUs Ins**	**CFUs Off**	**CFUs Rad**
Mechanic Engineering	ING-IND/16 Technologies and processing systems			
	Manufacturing and Assembly Technologies (1st year) - 6 CFUs - half-year			
	ING-IND/08 Fluid machinery			
	Internal Combustion Engines (1st year) - 6 CFUs - half-year			
	Advanced Combustion Systems (2nd year) - 6 CFUs - half-year			
	Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems (2nd year) - 6 CFUs - half-year			
	Powertrain Testing, Calibration and Homologation (2nd year) – 6 CFUs - half-year			
	ING-IND/15 Drawing and industrial engineering methods			
	Vehicle Conceptual Design (1st year) - 6 CFUs - half-year			
	ING-IND/14 Mechanic design and car manufacturing			
	Powertrain Design and Manufacturing (1st year) - 6 CFUs - half-year			
	ING-IND/13 Machinery applied mechanics			
	Mechanical Vibrations (1st year) - 6 CFUs - half-year			

Minimum of credits reserved to the university: - (minimum as per M.D. 45)

Total distinctive activities		48	48 - 66

Related activities	**sector**	**CFU Ins**	**CFU Off**	**CFU Rad**
Related or integrating training activities	ING-IND/21 Metallurgy *Science and Technology of Metallic and Composite Materials (1st year) - 6 CFUs - half-year* ING-IND/32 Converters, machinery and electric drives *Electric Drives (1st year) - 6 CFUs - half-year* *Electric Propulsion Systems (2nd year) - 6 CFUs - half-year* *Electromechanical Energy Storage and Conversion (2nd year) - 6 CFUs - half-year* ING-INF/01 Electronic systems *Electronics Systems (1st year) - 6 CFUs - half-year* ING-INF/04 Automation *Automated Controls (1st year) - 6 CFUs - half-year*	36	36	18 - 36 min 12
Total related activities			36	18 - 36

Other activities		**CFU**	**CFU Rad**
To be chosen by the student		12	12 - 12
For the final examination		12	12 - 12
Additional training activities	Additional language skills	-	0 - 6
	ITC skills	-	0 - 6
(Art. 10, paragraph 5, letter d)	Training and vocational internship programmes	6	6 - 12
	Additional knowledge useful for entering the job market	6	0 - 6
Minimum credits that the university reserves to Activities Art. 10, paragraph 5, letter d			12
For internship programmes in companies, public or private institutions, professional		-	-
Total Other Activities		36	36 - 54

Total CFUs for obtaining the degree **120**

Total CFUs provided in the programme Advanced Powertrain - *Bologna:* 120 102 - 156

Curriculum: High Performance Car Design

Distinctive activities	**sector**	**CFU Ins**	**CFU Off**	**CFU Rad**
	ING-IND/16 Technologies and processing systems			

Mechanic Engineering	*Manufacturing and Assembly Technologies (1st year) - 6 CFUs - half-year* ING-IND/15 Drawing and industrial engineering methods *Automotive Computer Aided Design CAD (1st year) - 6 CFUs - half-year* *Vehicle Conceptual Design (1st year) - 6 CFUs - half-year* ING-IND/14 Mechanic design and car manufacturing *FEM Fundamentals and Chassis Design (1st year) - 9 CFUs - half-year* ING-IND/13 Machinery applied mechanics *Mechanical Vibrations (1st year) - 6 CFUs - half-year* *Vehicle Dynamics (1st year) - 12 CFUs - half-year* *Vehicle NVH Testing (2nd year) - 6 CFUs - half-year* ING-IND/10 Industrial technical physics *CFD Fundamentals and Aerodynamics (1st year) - 9 CFUs - half-year* ING-IND/08 Fluid machinery *Automotive Fluid Power Systems (2nd year) - 6 CFUs - half-year*	66	66	48 - 66
	Minimum of credits reserved to the university: - (minimum as per M.D. 45)			
Total distinctive activities			66	48 - 66

Related activities	**sector**	**CFU Ins**	**CFU Off**	**CFU Rad**
Related or integrating training activities	ING-IND/21 Metallurgy *Science and Technology of Metallic and Composite Materials (1st year) - 6 CFUs - half-year* ING-INF/01 Electronic systems *Automotive Electronics Systems (2nd year) - 6 CFUs - half-year* ING-INF/04 Automation *Automated Controls (2nd year) - 6 CFUs - half-year*	18	18	18 - 36 min 12
Total related activities			18	18 - 36

Other activities		**CFU**	**CFU Rad**
To be chosen by the student		12	12 - 12
For the final examination		12	12 - 12
Additional training activities	Additional language skills	-	0 - 6
	ITC skills	-	0 - 6
(Art. 10, paragraph 5, letter d)	Training and vocational internship programmes	12	6 - 12
	Additional knowledge useful for entering the job market	-	0 - 6

Minimum credits that the university reserves to Activities Art. 10, paragraph 5, letter d 12

For internship programmes in companies, public or private institutions, professional	-	-	
Total Other Activities	36	36 - 54	

Total CFUs for obtaining the degree **120**

Total CFUs provided in the programme *High Performance Car Design*: 120 102 - 156

Curriculum: Racing Car Design

Distinctive activities	**sector**	**CFU Ins**	**CFU Off**	**CFU Rad**
Mechanic Engineering	ING-IND/10 Industrial technical physics *CFD Fundamentals and Aerodynamics (1st year) - 9 CFUs - half-year* ING-IND/16 Technologies and processing systems *Manufacturing and Assembly Technologies (1st year) – 6 CFUs - half-year* ING-IND/15 Drawing and industrial engineering methods *Automotive Computer Aided Design CAD (1st year) - 6 CFUs - half-year* *Vehicle Conceptual Design (1st year) - 6 CFUs - half-year* ING-IND/14 Mechanic design and car manufacturing *FEM Fundamentals and Chassis Design (1st year) - 9 CFUs - half-year* *Chassis and Body Design (2nd year) - 6 CFUs - half-year* ING-IND/13 Machinery applied mechanics *Mechanical Vibrations (1st year) - 6 CFUs - half-year* *Vehicle Dynamics (1st year) - 12 CFUs - half-year* ING-IND/12 Mechanical and thermal measurements *Dynamic Testing of Vehicles (2nd year) - 6 CFUs - half-year* **Minimum of credits reserved to the university: - (minimum as per M.D. 45)**	66	66	48 - 66
Total distinctive activities			66	48 - 66

Related activities	**sector**	**CFU Ins**	**CFU Off**	**CFU Rad**
	ING-IND/06 Fluid dynamics *Experimental Aerodynamics (2nd year) - 6 CFUs - half-year* ING-IND/21 Metallurgy			18 -

Related or integrating training activities	*Science and Technology of Metallic and Composite Materials (1st year) - 6 CFUs - half-year*	18	18	36 min 12
	ING-IND/22 Materials science and technology			
	Lightweight Materials and Composites (2nd year) - 6 CFUs- half-year			
Total related activities			18	18 - 36

Other activities		**CFU**	**CFU Rad**
To be chosen by the student		12	12 - 12
For the final examination		12	12 - 12
	Additional language skills	-	0 - 6
Additional training activities	ITC skills	-	0 - 6
(Art. 10, paragraph 5, letter d)	Training and vocational internship programmes	12	6 - 12
	Additional knowledge useful for entering the job market	-	0 - 6
	Minimum credits that the university reserves to Activities Art. 10, paragraph 5, letter d		12
For internship programmes in companies, public or private institutions, professional		-	-
Total Other Activities		36	36 - 54

Total CFUs for obtaining the degree 120

Total CFUs provided in the programme *Racing Car Design*: 120 102 - 156

Curriculum: Advanced Motorcycle Engineering

Distinctive activities	**sector**	**CFUs Ins**	**CFUs Off**	**CFUs Rad**
Mechanic Engineering	ING-IND/16 Technologies and processing systems	60	60	48 66
	Manufacturing and Assembly Technologies (1st year) - 6 CFUs - half-year			
	ING-IND/15 Drawing and industrial engineering methods			
	Vehicle Conceptual Design (1st year) - 6 CFUs - half-year			
	Vehicle Virtual Design (2nd year) - 6 CFUs- half-year			
	ING-IND/14 Mechanic design and car manufacturing			
	Powertrain Design and Manufacturing (1st year) - 6 CFUs - half-year			
	Chassis and Body Design and Manufacturing (2nd year) - 6 CFUs - half-year			
	ING-IND/13 Machinery applied mechanics			
	Mechanical Vibrations (1st year) - 6 CFUs - half-year			
	Motorcycle Vehicle Dynamics (2nd year - 6 CFUs - half-year			
	ING-IND/08 Fluid machinery			

	Internal Combustion Engines (1st year) - 6 CFUs - half-year *Modelling and Control of Internal Combustion Engines and Hybrid Propulsion Systems (2nd year) - 6 CFUs - half-year* *Powertrain Testing, Calibration and Homologation (2nd year) - 6 CFUs - half-year*			
	Minimum of credits reserved to the university: - (minimum as per M.D. 45)			
Total distinctive activities			60	48 - 66

Related activities	**sector**	**CFU Ins**	**CFU Off**	**CFU Rad**
Related or integrating training activities	ING-IND/21 Metallurgy *Science and Technology of Metallic and Composite Materials (1st year) - 6 CFUs - half-year* ING-IND/32 Converters, machinery and electric drives *Electric Drives (1st year) - 6 CFUs - half-year* ING-INF/01 Electronic systems *Electronics Systems (1st year) - 6 CFUs - half-year* ING-INF/04 Automation *Automated Controls (1st year) - 6 CFUs - half-year*	24	24	18 - 36 min 12
Total related activities			24	18 - 36

Other activities		**CFU**	**CFU Rad**
To be chosen by the student		12	12 - 12
For the final examination		12	12 - 12
Additional training activities	Additional language skills	-	0 - 6
	ITC skills	-	0 - 6
(Art. 10, paragraph 5, letter d)	Training and vocational internship programmes	6	6 - 12
	Additional knowledge useful for entering the job market	6	0 - 6
Minimum credits that the university reserves to Activities Art. 10, paragraph 5, letter d			12
For internship programmes in companies, public or private institutions, professional		-	-
Total Other Activities		36	36 - 54

Total CFUs for obtaining the degree **120**

Total CFUs provided in the programme *Advanced Motorcycle Engineering*: 120 102 - 156

Curriculum: Advanced Sports car Manufacturing

Distinctive activities	**sector**	**CFU Ins**	**CFU Off**	**CFU Rad**

Mechanic Engineering	ING-IND/17 Mechanic industrial installations *Automotive Manufacturing and Assembly Systems (2nd year) - 6 CFUs - half-year* *Industrial Plants Design (2nd year) - 6 CFUs - half-year* *Operation & Supply Chain Design and Management (2nd year) - 6 CFUs - half-year* ING-IND/16 Technologies and processing systems *Manufacturing and Assembly Technologies (1st year) - 6 CFUs - half-year* ING-IND/15 Drawing and industrial engineering methods *Vehicle Conceptual Design (1st year) - 6 CFUs - half-year* ING-IND/14 Mechanic design and car manufacturing *Powertrain Design and Manufacturing (1st year) - 6 CFUs - half-year* ING-IND/13 Machinery applied mechanics *Mechanical Vibrations (1st year) - 6 CFUs - half-year* *Industrial Robotics (2nd year) - 6 CFUs - half-year* ING-IND/08 Fluid machinery *Internal Combustion Engines (1st year) - 6 CFUs - half-year* **Minimum of credits reserved to the university: - (minimum as per M.D. 45)**	54	54	48 - 66
Total distinctive activities			54	48 - 66

Related activities	**sector**	**CFU Ins**	**CFU Off**	**CFU Rad**
Related or integrating training activities	ING-IND/21 Metallurgy *Science and Technology of Metallic and Composite Materials (1st year) - 6 CFUs - half-year* ING-IND/32 Converters, machinery and electric drives *Electric Drives (1st year) - 6 CFUs - half-year* ING-INF/01 Electronic systems *Electronics Systems (1st year) - 6 CFUs - half-year* *Algorithms and Systems for Big Data Processing (2nd year) - 6 CFUs - half-year* ING-INF/04 Automation *Automated Controls (1st year) - 6 CFUs - half-year*	30	30	18 - 36 min 12
Total related activities			30	18 - 36

Other activities	**CFU**	**CFU Rad**
To be chosen by the student	12	12 - 12
For the final examination	12	12 - 12
Additional language skills	-	0 - 6
ITC skills	-	0 - 6
Additional training activities		

(Art. 10, paragraph 5, letter d) Training and vocational internship programmes	6	6 - 12
Additional knowledge useful for entering the job market	6	0 - 6
Minimum credits that the university reserves to Activities Art. 10, paragraph 5, letter d		12
For internship programmes in companies, public or private institutions, professional	-	-
Total Other Activities	36	36 - 54

Total CFUs for obtaining the degree **120**

Total CFUs provided in the programme *Advanced Sports car Manufacturing*: 120 102 - 156

Distinctive activities

If sectors NOT belonging to the class have been entered next to min and max CFUs in square brackets, the CFUs only reserved to the class sectors are indicated

disciplinary sector	sector	Minimum		CFUs as per M.D. for the area
		min	max	
Mechanic Engineering	ING-IND/08 Fluid machinery ING-IND/09 Energy and environmental systems ING-IND/10 Industrial technical physics ING-IND/12 Mechanical and thermal measurements ING-IND/13 Machinery applied mechanics ING-IND/14 Mechanic design and car manufacturing ING-IND/15 Drawing and industrial engineering methods ING-IND/16 Technologies and processing systems ING-IND/17 Mechanic industrial installations	48	66	-
Minimum of credits reserved to the university minimum as per M.D. 45:		-		
Total distinctive activities				48 - 66

Related activities

disciplinary area	sector	Minimum		CFUs as per M.D. for the area
		min	max	
Related or integrating training activities	CHIM/02 - Physical chemistry ING-IND/06 Fluid dynamics ING-IND/11 - Environmental technical physics ING-IND/21 Metallurgy ING-IND/22 - Materials science and technology ING-IND/32 - Converters, machinery and electric drives ING-IND/35 - Economic-managerial engineering ING-INF/01 - Electronic systems ING-INF/03 - Telecommunications ING-INF/04 Automation ING-INF/05 - Information processing systems	18	36	12

	ING-INF/07 - Electric and electronic measurements MAT/08 - Numerical analysis

Total related activities	18 - 36

Other Activities

disciplinary area		CFUs min	CFUs max
To be chosen by the student		12	12
For the final examination		12	12
Additional training activities (Art. 10, paragraph 5, letter d)	Additional language skills	0	6
	ITC skills	0	6
	Training and vocational internship programmes	6	12
	Additional knowledge useful for entering the job market	0	6
Minimum credits that the university reserves to Activities Art. 10, paragraph 5, letter d		12	
For internship programmes in companies, public or private institutions, professional associations		-	-

Total Other Activities	36 - 54

CFU summary

Total CFUs required for obtaining the degree		**120**
Range of total CFUs for the programme	102 - 156	

University communication to the National University Centre

Notes relating to basic activities

Notes relating to other activities

Reasons why sectors belonging to the class have been included into related activities or Notes to related activities

The wide presence of related or integrating training activities in the education programme is mainly a consequence of the strong multidisciplinary nature of the profile of the modern High Performance Vehicle Engineer. Such profile has been designed through a consistent exchange programme with the stakeholders of the automotive sector, and in particular thanks to the contribution of the most famous brands of the automotive and motorcycle sector based in the Emilia-Romagna region and operating at an international level.
Therefore, in order to accomplish the target of training engineers able to face the challenges of the near future in the automotive sector, and starting from the limited group of distinctive activities provided for in the degree class of Mechanic Engineering, typical skills of the IT and Automation field (ING-INF/01, ING-INF/03, ING-INF04, ING-INF/05, ING-IND/35, MAT/08), of the Materials field (CHIM/02, ING-IND/21, ING-IND/22), of the Energy field (ING-IND/06, ING-IND/11), and mainly of the Electric field (ING-IND/32, ING-INF/07) had to be included in the training programme.
As it has been already observed, based on the accurate and documented indications received by the stakeholders, it has been necessary to reduce the basic multidisciplinarity required by the Advance Automotive Engineer profile within an industrial frame that requires the breakdown in professional specialisations relating to: road vehicle architecture, racing vehicle architecture, powertrain system, motor vehicle, production. Such process has generated a wide range of credits assigned to the related or integrating training activities included in the programme, without playing down the cultural significance of a programme that takes the degree class of Mechanic Engineering towards a plausible degree class in Vehicle Engineering.
With regard to the disciplinary areas outlined above and the specialisations identified, it should be observed, for example, that the IT and Automation field is extremely important for all the specialisations except that relating to the racing vehicle architecture, for which, conversely, it becomes more central both in terms of the Materials and Energy fields, mainly because of the connection with the lightweight, aerodynamics and prototype aspects. Ultimately, the Electric field, which plays an essential role in the development of the most modern powertrains, becomes significantly less important for the profiles related with the design of cold units and subunits in the high-performance road and racing vehicle architectures
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Notes relating to distinctive activities