

APPENDIX 1

ART. 1 - TYPOLOGY OF MASTER'S PROGRAMME

The University of Pavia has activated a first-level Master's course in "**Design and Development of Vehicle Dynamics**" at the Department of Industrial Engineering and Information for the 2020/2021 academic year. The course takes advantage of the educational, logistic and organizational collaboration of ASC S.r.l. (Quattroruote Automotive Safety Centre).

Edition: III

Disciplinary Area: Ingegneria Industriale

ART. 2 - EDUCATIONAL AIMS, PROFESSIONAL OPPORTUNITIES AND COURSE APPEAL

The Master's course is aimed at training highly qualified professionals, providing students with a solid preparation in the field of vehicle dynamics design so that they are able to work in all phases of vehicle setup and development, from dynamic simulation to the testing of prototypes right up until the realization of the pre-series vehicle. Specific competence will be acquired by Master's students in techniques of testing and in the trial of vehicles, both virtually, by means of CAE systems, in particular through the use of driving simulators, and experimentally by working directly on a vehicle (on the test circuit and on the road). An absolutely innovative element of the training course, alongside the lectures, are testing sessions on the circuit of the Quattroruote Safe Driving Centre during which the participants will be personally involved in learning the techniques and methodologies that are used in the testing, control and fine tuning of the dynamic behaviour of vehicles. For all participants, a specially designed advanced driving course is planned at the introductory level and oriented towards the successive phase of trials and testing on the track.

The Master's course is supplemented by targeted training and the continuous use of a static simulator installed in a designated room at the university and by a working session on a dynamic simulator at the VI-Grade centre of Tavagnacco (UD) or at the Danisi Engineering company of Nichelino (TO), partner companies of the program.

Qualified postgraduates of the Master's course can find employment with all those industrial groups which, in various capacities, operate in the field of design, development and the production of vehicles and more generally in the automotive sector. In particular, the skills acquired during the Master's course are of fundamental importance in the design, testing and development phases of the dynamic behaviour of new vehicles. This role of the professional design test engineer, urgently required by the market, is not available on the current panorama of academic training and is sought after both by mature markets like that of Italy and by markets that are just emerging from the point of view of the automotive industry. In addition, the Master's course, in what is a world first, contributes towards the training of a completely new professional position, which can be defined as a "*Certified*" CAE Driving Simulator Engineer, reserved for those students involved in internship activities who are specifically oriented towards in-depth training and the development of projects using the simulator.

The first level University Master's course in "Design and Development of Vehicle Dynamics," which is offered to international students, is aimed at young engineers who are passionate about the automotive world.

Affiliated with the programme are firms such as McLaren, Pirelli, CD Adapco/Siemens, Seat, Thyssen Presta, AudiSport, ZF-TRW, Ycom, Brembo, Lamborghini, Prema, Team Lazarus, JAS Motorsport, Tatuus, Autotecnica Motori, Maserati, Alfa Romeo, Magneti Marelli, FCA, Abarth, Ferrari, Michigan Scientific, Michelin, Oreste Berta, Danisi Engineering are involved in the course in various capacities.

ART. 3 – MASTER'S DEGREE PROGRAMME

The Master's course lasts one year (1,500 total hours - **60 CFU**) and can be broken down into:

lectures held at the University of Pavia (Faculty of Engineering and at Palazzo Vistarino), and the ASC - Centro di Guida Sicura (Vairano di Vidigulfo, PV), practical training at ASC – Safe Driving Centre (Vairano di Vidigulfo, PV), technical visits to structures related to the course, final internship with partner companies, seminars, study activities, preparation and individual training.

Lessons for the Master's course are expected to begin in October 2020.

Technical seminars will be given by researchers from our university or from other universities, including the Federico II University of Naples, the University of Pisa and the Polytechnic of Milan, along with experts from various companies including FCA, Abarth, VI-Grade, Pirelli, Seat, CSI, MegaRide, Brembo, Danisi Engineering, Alfa Maserati. There will also be technical visits to the test centre of Balocco (FCA), the Driving Simulator Centre of Danisi Engineering, the CSI headquarters and laboratories, and the Pirelli circuit at Vizzola Ticino.

In the new edition of the Master's course, two unique and very innovative seminars will be introduced:

- 1) Theoretical and practical seminar on ADAS (Advanced Driver Assistance Systems) conducted by ASC technical staff; during the two-day seminar, the main issues concerning the technical characteristics and the evaluation of the effectiveness and efficiency of the ADAS systems currently used on road vehicles will be addressed. The experimental seminar will be conducted with the exclusive "UFO" (UltraFlat Overrunnable robot) instrumentation supplied to the ASC centre.
- 2) Experimental seminar on vehicles equipped with WFT (Wheel Force Transducer) sensors designed in collaboration with FCA.

Student attendance at the various training activities is mandatory for at least 75% of the total number of hours. The training period cannot be suspended.

Transfers to similar Master's courses at other universities are not permitted.

The Master's course, which mainly addresses an international market, may be conducted in English depending on the number and nationality of enrolled students.

The teaching modules are organized as follows:

Module	SSD	Contents	Number of lecture hours.	Hours of training / laboratory	Hours individual study	Total number of hours	CFU
I) Integrated teaching: Design and Development of Vehicle Dynamics							
1) <i>Total Vehicle Design</i>	ING-IND13, ING-IND14, ING-IND15 ING-IND06	International Scenario and methodology process. Total vehicle benchmark Analyses. Methodology processes for total vehicle Design. Aerodynamics for Dynamics performances improvement and fuel consumption control. Integration between Aerodynamics and Style.	60	0	90	150	6

2) <i>Fundamental Driving Dynamics</i>	ING-IND13	The role of K&C Rig Testing with CAE models. Chassis subsystem modeling for R&H. Full vehicle virtual prototypes for Handling and Ride-Comfort. Road loads data prediction. Multi-attribute balancing. Coordinating with Control system development. Advanced experimental body modal contribution techniques. Integrated Engineering development process. Advanced driver assistance systems and autonomous driving.	40	0	60	100	4
3) <i>Virtual Dynamics Design and Simulation</i>	ING-IND13	Multibody analyses introduction. Adams Car. Real-time analyses. From real-time virtual Dynamics to Dynamic driving simulator.	8	32	60	100	4
II) Insegnamento integrato: Materiali, Propulsione e Controllo							
4) <i>Materials and structural resistance</i>	ING-IND21, ICAR08	Materials for the Automotive Sector. Technologies, Processes. Features. Methods of topological optimization for verifying the body and components.	40	0	60	100	4
5) <i>Propulsion: ICE, Hybrid, Electric</i>	ING-IND32 ING-IND08	Internal combustion engines. Principal characteristics and features. Architecture. Consumption. Electric Motors. Generators. Accumulation Systems. Power supply. Recharging. Connection Systems. Wiring. Protocols. Diagnostics.	20	0	30	50	2
6) <i>Vehicle Dynamic Control</i>	ING-INF04	Introduction to the main regulators. Braking control systems, stability, traction, and vector control. – Classical problems, Vehicle dynamic control, Measurements, sensors and observers	10	0	15	25	1
III) Insegnamento integrato: Sperimentazione veicolo e Interazione pilota/veicolo							
7) <i>Total Vehicle Testing and Development</i>	ING-IND13, ING-IND14, ING-IND06	Total vehicle development process, experimental and CAE. Standardized subjective and objective experimental tests to develop and evaluate Dynamic and Ride Comfort behaviour. Driving course to learn Experimental Development Process: from test results to problem solving. Methodology to recognize problems and to approach problem solving. Failure Mode and Effect Analyses.	12	48	90	150	6

8) Biomechanics: Driver/Vehicle Interaction – <i>Human/vehicle interaction</i>	ING-IND13, ING-IND34, ING-INF05, ING-INF06	Methodology and tools for the evaluation of driver/vehicle interaction. Comfort and features. Integrated system of measurement and monitoring. Driver physiology. Psychophysical stress and physiological adaptation. Environmental factors.	14	56	105	175	7
Partial total of hours/CFU			204	136	510	850	34
Internship-training-seminars						600	24
Final exam						50	2
Total hours/CFU						1500	60

ART. 4 – IN-COURSE ASSESSMENTS

Learning is assessed during the course by the teachers giving the lessons and practicals, leading the seminars and the practical tests, and supervising the students' work. There is no specific mark for course examinations and the final exam.

ART. 5 – FINAL EXAMINATION AND CONFERMENT OF QUALIFICATION

The final exam will entail the presentation and defence of a written thesis regarding the traineeship activity undertaken by the candidate.

At the end of the Master's course, participants who have completed all of the activities and fulfilled their obligations and passed the final exam, will be awarded a Level I Master's degree in:
"Design and Development of Vehicle Dynamics".

ART. 6 – FACULTY

Teaching will be carried out by faculty from the University of Pavia and from other universities as well as by highly-qualified outside experts.

ART. 7 – ADMISSION REQUIREMENTS

The Master's programme is aimed at students who possess:

1. **a degree in accordance with D.M. (Ministerial Decree) 270/2004 pertaining to the class of degrees in:**
 - Industrial engineering - L-9
with particular reference to degree programmes in mechanical, aerospace, electrical, energy, mechatronics, industrial, materials, and automotive engineering
2. **a degree in accordance with D.M. 509/99 pertaining to the class of degrees in:**
 - Industrial Engineering - 10
with particular reference to degree programmes in mechanical, aerospace, electrical, energy, mechatronics, industrial, materials, and automotive engineering.
3. **a second-cycle degree in accordance with D.M. 270/2004 pertaining to one of the following classes:**
 - Mechanical Engineering - LM-33
 - Aerospace and astronautics engineering - LM-20
 - Electrical Engineering - LM-28
 - Energy and nuclear engineering - LM-30
 - Science and the Engineering of Materials - LM-53
 - Automation Engineering - LM-25

4. a specialist degree in accordance with D.M. 509/99 pertaining to one of the following classes:

- Mechanical engineering - 36 / S
- Aerospace and astronautics engineering - 25 /S
- Electrical Engineering - 31 /S
- Energy and nuclear engineering - 33 /S
- Science and the Engineering of Materials - 61 /S
- Automation Engineering - 29 /S

5. a degree in accordance with the previous regulations in:

- Mechanical engineering
- Industrial engineering
- Aerospace engineering
- Electrical engineering
- Nuclear engineer
- Materials engineering

In the event of admissions applications from foreign students, the Faculty Board will evaluate the equivalence of the foreign degree and the Italian degree required for admission to the Master's programme.

The maximum number of enrolments is **14**.

The minimum number necessary for activation of the course is **7** enrolments.

The Faculty Board may also assess whether the conditions exist for extending the aforementioned number of places.

If the number of applicants exceeds the maximum number called for, a Committee made up of the Coordinator and two members of the Master's faculty will determine a ranking based on merit (expressed in hundredths) which takes into account the following evaluation criteria:

1. Up to a maximum of 30 points for the graduation mark as follows:
 - 10 points for a graduation mark <than 100/110
 - 11-21 points for graduation marks from 100/110 to 110/110 (for a mark of 100 points, 11 points are awarded, and the score is increased by one point for every additional mark achieved)
 - 30 points for marks of 110/110 'cum laude'
2. Up to a maximum of 70 points for an interview in Italian or English, whose aim is to evaluate the competencies, capacities and motivations of the candidate regarding the content and specific objectives of the Master's programme. Special recognition will be given for any work experience in the automotive sector – such as scientific publications related to the topic area of the Master's – and for knowledge of specific development software such as Matlab, Simulink, Adams, etc. Students pass the interview with a score of at least 42/70.

In case of a tie in the rankings, the younger candidate will be given preference.

Should one or more candidates who are admitted to the course renounce their place, such places shall be made available to those candidates whose names appear in the final classification, until all places are assigned.

AUDITORS

Some companies have expressed an interest in having their employees take part in single modules of the Master's course for a fee. Therefore a small number of professionals are expected to be admitted to the course as auditors for this edition.

The auditors, employees of partner companies of the Master's course or professionals, must have proven experience in the automotive sector and can participate in up to 5 modules.

The cost of the modules is broken down as follows:

Module 1 (60 hours, classroom) € 3,000

Module 2 (40 hours, classroom) € 2,000

Module 3 (40 hours, classroom) € 2,000

Module 7 (60 hours: ASC driving course + ASC Vairano circuit activity) € 7,000

Module 8 (70 hours, classroom and practical activity) € 3,500.

ART. 8 - DEADLINE FOR ADMISSION APPLICATION

Candidates must send off their application for admission, according to the procedures established by the Call for Applications, **from 7 August 2020 until the deadline of 25 September 2020.**

ART. 9 - ATTACHMENTS TO THE APPLICATION

Candidates must attach the following documentation during the online registration procedure for the Master's course:

- application for admission to the Master's programme (the form to be used is on page 7)
- photocopy (double-sided) of the personal identification document included during registration;
- in the case of a qualification obtained abroad:
 - ✓ copy of the qualification required for admission, along with exams taken and corresponding marks, translated into Italian
 - ✓ copy of the "declaration of value" issued by the Italian Embassy/Consulate in the country where the academic qualification was obtained (only if already available)
- **Transcript of records** (or self-certification of exams passed during university studies in Italy) with details of the marks obtained;
- **references;**
- **motivational letter;**
- **curriculum vitae** highlighting any professional experience in work areas pertaining to the Master's course;

Please note that as indicated in Article 3 of the General Call for admissions, candidates holding a qualification obtained abroad must, **before the deadline of 11/01/2021**, deliver **the original** of the following documentation, legalized by the Italian Embassy or Consulate in the country where the aforementioned qualification was obtained, to the Health and Post-Graduate Service - Exams of State (via Ferrata No. 5 Pavia):

- academic qualification required for admission indicating the exams taken and corresponding marks, translated into Italian
- "declaration of value"

The above requisites must already be in the candidate's possession by the deadline for the submission of the application for admission.

ART. 10 - UNIVERSITY TUITION AND FEES

Enrolment:

Those enrolled in the Master's course must pay the sum of € 15,000.00 inclusive of: € 16.00 (stamp duty) and € 142.00 (administrative fees) for the 2020/2021 academic year.

This amount must be paid in two instalments:

- First instalment of € 10,000.00 to be paid upon enrolment;
- Second instalment of € 5,000.00 to be paid by 11/01/2021.

Final exam:

To be admitted to the final exam, candidates must submit the application form along with the payment of € 116 as a fee for the issuance of the Master's diploma (including n°2 stamp duty paid virtually: one for the parchment and one for the application).



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ART. 11 – WEB SITE AND ORGANIZATIONAL SECRETARIAT:

Any communication to candidates will be announced by means of publication on the following **websites**:

http://iii.unipv.it/index_en.php?pag=teaching/master.html

<http://vehicledynamics.unipv.it/>

For information on the organization of the course contact the:

Organizational Secreteriat

Department of Industrial Engineering and Information

Prof. Carlo E. Rottenbacher, Ms. Laura Pecoraro

Tel. 0382/6992200

Fax 0382/6992228

E-mail: info.vehicledyn@unipv.it

APPLICATION FORM

Ist LEVEL MASTER: "DESIGN AND DEVELOPMENT OF VEHICLE DYNAMICS"

(the form, duly filled in, must be uploaded in the on-line procedure of admission to the master course as per issue n°9 of the annex to the relevant call for admissions)

The undersigned (FORENAME, SURNAME) _____

Date of birth _____ City _____ State _____

State of residence _____ Permanent address _____

_____ E-mail _____

APPLIES

For admission to the aforementioned master course

And ATTACHES

to the formal admission form the following papers **to be submitted mandatorily for the application**

evaluation:

1. photocopy of the personal ID document/passport uploaded during the on-line registration procedure;
2. transcript of records/self declaration of the passed exams during the Italian academic career reading relevant marks.
3. In addition, whoever achieved a foreign academic title must attach:
 - ✓ copy of the Degree diploma
 - ✓ copy of the "declaration of value" issued by the Italian Embassy/Consulate in the State where the academic title had been released (only if already available)
4. reference letter;
5. motivational letter;
6. CV listing professional experiences in working environments pertaining the above master.

Date, _____

Signature _____