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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 2021/2022 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: Industrial Engineering

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 ASC (Automotive Safety Centre) – Quattroruote, 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 to the use of the compact VI-grade simulator and a work 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 ASC, VI-grade, McLaren, Pirelli, CD Adapco/Siemens, Seat, Thyssen Presta, AudiSport, ZF-TRW, Ycom, Brembo, Lamborghini, Continental, Prema, Team Lazarus, JAS Motorsport, Tatuus, Autotecnica Motori, Maserati, Alfa Romeo, Magneti Marelli, FCA, Abarth, Ferrari, Michigan Scientific, Michelin, Oreste Berta, PCB, Kistler, Danisi Engineering, Skydrive.

The current context of crisis in the automotive sector, also due to the pandemic in progress, can find a way to relaunch also thanks to the acquisition of highly trained human resources not only from a theoretical and methodological point of view but also on the most innovative design techniques and experimentation currently available and which constitute the main area of specialization of the Master's courses.

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 2021.

The institutional location of the Master is at the Faculty of Engineering where the lectures and computer exercises are held. Seminars and meetings with companies are held at Palazzo Vistarino, headquarters of the Alma Mater Ticinensis Foundation.

Lectures and seminars will be held by researchers from the University of Pavia, by researchers from other universities including University of Naples Federico II, University of Pisa, Politecnico di Milano, Sheffield Hallam University and by experts from companies such as FCA, Abarth, VI-Grade, Pirelli, Seat, CSI, MegaRide, Brembo, Danisi Engineering, Alfa Romeo, Maserati, CSI, Kistler, PCB. There will be technical visits to the Balocco (FCA) experimental center, the *Driving Simulator Center* of Danisi Engineering, the CSI center, the Pirelli laboratories and the Pirelli circuit in Vizzola Ticino.

In the new edition of the Master's course, some unique and very innovative seminars and workshop will be offered:

- 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 vehicle dynamics designed in collaboration with FCA;
- 3) Seminar on experimental aerodynamics;
- 4) Seminar on vehicle instrumentation with a view to dynamics, durability and comfort.

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. Some lessons may be online.

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) Total Vehicle Design	ING-IND/13, ING-IND/14, ING-IND/15 ING-IND/06	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) Fundamental Driving Dynamics	ING-IND/13	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) Virtual Dynamics Design and Simulation	ING-IND/13	Multibody analyses introduction. Adams Car. Real-time analyses. From real-time virtual Dynamics to Dynamic driving simulator.	8	32	60	100	4
II) Integrated teaching: Materials, Propulsion and Control							
4) Materials and structural resistance	ING-IND/21, ICAR/08	Materials for the Automotive sector. Technologies, Processes. Features. Methods of topological optimization for verifying the body and components.	40	0	60	100	4
5) Propulsion: ICE, Hybrid, Electric	ING-IND/08, ING-IND/32	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) Vehicle Dynamic Control	ING-INF/04	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) Integrated teaching: Vehicle experimentation and pilot / vehicle interaction							
7) Total Vehicle Testing and Development	ING-IND/13, ING-IND/14, ING-IND/06	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) Human/vehicle interaction	ING-IND/13, ING-IND/34, ING-INF/05, ING-INF/06 BIO/09, MED/34	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 n° of hours/CFU	1500	60

ART. 4 - IN-COURSE ASSESSMENT

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 ACHIEVEMENT OF THE 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 DD.MM. (Ministerial Decrees) 509/99 and 270/2004, pertaining to the class of degrees in:**

Industrial engineering – 10; L-9
with particular reference to Degree programmes in mechanical, aerospace, electrical, energy, mechatronics, industrial, materials, and automotive Engineering.

2. **a second-cycle degree in accordance with DD.MM. 509/99 and 270/04 pertaining to the class of degrees in:**

Mechanical engineering – 36/S; LM-33	Energy and nuclear engineering – 33/S; LM-30
Aerospace and astronautics engineering – 25/S; LM-20	Science and the Engineering of Materials – 61/S; LM-53
Electrical engineering – 31/S; LM-28	Automation engineering – 29/S; LM-25

3. **a degree in accordance with the previous regulations in:**

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

In the event of admissions applications from foreign students, the Academic 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 n° **7** enrolments.

The Academic 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 Academic Board 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 June 2021 until the deadline of 25 September 2021**.

ART. 9 - ATTACHMENTS TO THE APPLICATION

Candidates must attach the scan of the following documents during the online registration procedure for the Master's course:

- 1) **application form** (the form to be used is on page 9);
- 2) front-rear of the **personal identification document** uploaded during registration;
- 3) **self-declaration** of the exams taken during the academic career (only for those who have obtained the academic qualification in Italy);
- 4) in case of a qualification obtained abroad:
 - a. **Academic qualification** required for admission in Italian or English;
 - b. **"Declaration of value"** issued by the Italian diplomatic representative situated in the country to which the institution that issued the qualification belongs;
 - c. **Degree certificate** in Italian or English with the exams taken and the relative marks (transcript of records);
 - d. As an **alternative** to the "Declaration of value", the University recognizes the following documents as valid:
 - **Diploma supplement** (if the foreign qualification is issued by an European University);
 - **Certificate of comparability** issued by [Naric](#) / [Cimea](#);
- 5) **letter of reference**;
- 6) **motivational letter**;
- 7) **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 enrolment deadline or at least by 11 January 2022**, deliver **the original** of the following documentation, **together with a declaration of legal validity from the Italian diplomatic representative situated in the state where the qualification was issued and handed in**, to Servizio Post Laurea - Ufficio Master (via Ferrata, 5 - 27100 Pavia).

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 tax) and € 142.00 (administrative fees) for the 2021/2022 academic year.

This amount must be paid in **two installments**:

- 1° installment of € 10,000.00 to be paid upon enrolment;
- 2° installment of € 5,000.00 to be paid by **11 January 2022**.

Final exam:

To be admitted to the final exam, candidates must submit a specific application form along with the payment of **€ 116.00¹** as a fee for the issuance of the Master's diploma (including n° 2 stamp duty tax paid virtually: one for the parchment and one for the application).

ART. 11 - WEB SITE AND ORGANIZATIONAL SECRETARY

Any communication to candidates will be announced by means of publication on the following **website**: <http://vehicledynamics.unipv.it/>

¹ Please note that the amount may be updated by resolution of the Board of Directors after the publication of this Notice.



Servizio Post Laurea

For information on the organization of the course contact:

Organizational Secretary

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
TO I 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. front-back of the personal ID document/passport uploaded during the on-line registration procedure;
2. self-declaration of the passed exams during the academic career reading relevant marks (only for whom have an Italian academic title);
3. In addition, whoever achieved a foreign academic title must attach:
 - ✓ Academic qualification required for admission in Italian or English;
 - ✓ "Declaration of value" issued by the Italian Embassy/Consulate in the State where the academic title had been released (only if already available);
 - ✓ Degree certificate in Italian or English with the taken exams and the relative marks (transcript of records);
 - ✓ As an alternative to the "Declaration of value on site", the University recognizes the following documents as valid:
 - Diploma supplement (if the admission qualification to the Master is issued by a European University);
 - Certificate of comparability issued by Naric / Cimea;
4. reference letter;
5. motivational letter;
6. CV listing also professional experiences in working environments pertaining the above Master, if any.

Date, _____

Signature _____