



# UNIVERSITÀ DEGLI STUDI DI PAVIA

Servizio Qualità della Didattica e Servizi agli Studenti

**Attach. A to call for applications  
published on 18/07/2017**

## **ART. 1 - TYPOLOGY**

The University of Pavia announces for academic year 2017/2018, a one-year, first level Masters course in “**Design and Development of Vehicle Dynamics**” at the Department of Industrial Engineering and Information Technology. The Master’s didactic, logistic and organizational set-up is designed in collaboration with Editoriale Domus S.p.a. (Quattroruote Academy e Centro Prove Quattroruote) e ASC S.r.l. (Quattroruote Safe Driving Centre).

## **Second edition**

## **ART. 2 – EDUCATIONAL GOALS**

The Master aims to train a new highly qualified professional profile with a strong competence in the design of vehicle dynamics and capable of operating in every stage of vehicle setting-out and development, from the dynamic simulation to the test drive of the prototype up to the realization of the pre-production vehicle. Masters students will acquire a particular specializing competence about vehicle testing techniques, gained both by means of virtual reality (CAE device), and first-hand experience aboard a physical vehicle (on track and on the road). The educational offer consists of frontal lessons and mainly the absolutely innovative feature of test sessions on the Quattroruote Safe Driving Centre circuit. During such sessions attendees will experience at first hand the techniques and methods employed in the tests, in the test drive, in the control and honing of the vehicle dynamic performance. All the participants will enjoy a preliminary advanced driving course, expressly devised to introduce to the further phase of test and test drive on track.

The educative itinerary is completed by the use of a static simulator that will be made available to the masters students through the entire duration of the study course, and by a working session using a dynamic simulator at the site of the VI-Grade Centre in Tavagnacco (UD), a company partner of the programme.

Students attaining the Master degree may find professional opportunities at the international companies operating at different level either in the engineering design field, or in the vehicle development and production field and, with a more general scope, in the automotive environment. In particular, the cutting-edge competence acquired attending this Master is apt to become a tipping point key in the new vehicles design, test and development of the dynamic performance phases. Such strongly sought-after professional profile of engineer as developer of vehicle dynamics and test driver has no comparison in the range of current academic offer and is searched for both in a mature market such as the Italian one, and on markets still developing from the automotive sector point of view. Moreover the master, a world premiere, contributes to train a totally new professional figure: the *Certified CAE Driving Simulator Engineer*. It is a privilege reserved to the master’s students who will be carrying out a specific internship expressly set up to enhance the training and to develop the project by means of the simulator.

The first level Masters course in “**Design and Development of Vehicle Dynamics**” is recommended to young engineers with a knack for the automotive world and is offered to international students.

## **ART. 3 - DEGREE COURSE PROGRAMME**

The duration of the Masters course is **one year** and has a timetable of **1500** hours, including:

- frontal lessons at:

the University of Pavia - Palace Vistarino venue, Editoriale Domus at Rozzano (MI) , and ASC S.r.l - the Quattroruote Safe Driving Centre seated at Vairano - Vidigulfo (PV),

- practical sessions at ASC S.r.l., the Quattroruote Safe Driving Centre located in Vairano - Vidigulfo (PV)
- guided tours at plants and facilities operating in the automotive sector, final internship at partner companies, seminars, didactic activities and individual preparation.



# UNIVERSITÀ DEGLI STUDI DI PAVIA

Servizio Qualità della Didattica e Servizi agli Studenti

The master's seat is located at Vistarino Palace in Pavia, a venue which allows both international and domestic students to interact with professors and professionals during informal meetings and occasions to get together, thanks to the accommodation service there offered.

Technical seminars will be held by researchers of both our and other universities, among which: University Federico II – Naples, University of Pisa, University of Modena and Reggio Emilia, Politecnico di Milan, and by professional experts from firms such as: FCA, Maserati, VI-grade, Bridgestone, CSI, MegaRide, Brembo.

Moreover technical visits at the proving ground of Balocco (FCA) will be arranged, the centre R&D Lamborghini, Driving Simulator Centre of Danisi Engineering, the seat and laboratories of CSI, the Pirelli track in Vizzola Ticino.

In total, the course activities correspond to 60 CFUs (university credits).

Students **must** attend at least 75% of the overall course activity hours.

The course cannot be suspended.

Transfers from other Masters courses at other universities are not permitted.

Teaching/Modules are thus organised:

Teaching/ Module	Scientific- disciplinary sector (SDS)	Content	H of frontal lessons	H of practical sessions / lab work	H of individual study	Total H	CFUs
I) Combined teaching: Design of Vehicle Dynamics							
1) Total Vehicle Design	ING-IND/13, ING-IND/14, ING-IND/15	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

Teaching/ Module	Scientific- disciplinary sector (SDS)	Content	H of frontal lessons	H of practical sessions / lab work	H of individual study	Total H	CFUs
---------------------	--	---------	----------------------	---------------------------------------	-----------------------	---------	------



# UNIVERSITÀ DEGLI STUDI DI PAVIA

Servizio Qualità della Didattica e Servizi agli Studenti

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) Combined teaching: Materials, Propulsion and Control							
4) Materials and structural design	ING-IND/21, ICAR/08	Materials for the <i>Automotive Engineering</i> . Technologies. Processes. Performances. Topological optimization methods for chassis and components verifications.	40	0	60	100	4
5) Propulsion: IC & Hybrid	ING-IND/08, ING-IND/32	Internal combustion engines. Main features and performances. Engine architectures. Fuel consumptions and performances. Electric motors. Generators. Batteries and accumulators. Power supply system. Recharge systems. Connection systems. Cable connection wires. Protocols. Diagnostics.	20	0	30	50	2
6) Vehicle dynamic control	ING-INF/04	Introduction to control systems and regulators. Breaking control systems, stability control systems and traction control systems, Vector control.	10	0	15	25	1
<b>Teaching/ Module</b>	<b>Scientific- disciplinary sector (SDS)</b>	<b>Content</b>	<b>H of frontal lessons</b>	<b>H of practical sessions / lab work</b>	<b>H of individual study</b>	<b>Total H</b>	<b>CFUs</b>
III) Combined teaching: Vehicle test and driver/vehicle interaction							



# UNIVERSITÀ DEGLI STUDI DI PAVIA

Servizio Qualità della Didattica e Servizi agli Studenti

7) Total Vehicle Testing and Development	ING-IND/13, ING-IND/14, ING-IND/04	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	ING-IND/13, ING-IND/34, ING-INF/06, BIO/09	Methods and instrumentations for driver/vehicle interaction and its evaluation and monitoring. Comfort and performances. Integrated system for the driver training . Driver/pilot physiology. Psycho-physical stress and physiological adaptation. Environmental factors.	14	56	105	175	7
Partial total			204	136	510	850	34
Internship-Stage						600	24
Final exam						50	2
<b>Total</b>						<b>1500</b>	<b>60</b>

#### ART. 4 – LEARNING ASSESSMENTS

Learning will be assessed during the course by professors who hold lessons, seminars, lab works, practical sessions and follow students' work.

Progress assessments and a final test, if administered to students, will not ensure a final grade.

#### ART. 5 - OBTAINING THE QUALIFICATION

At the end of the Masters course, students who have completed all the activities and met all the programmed obligations will be awarded a first level Masters Diploma in "Design and Development of Vehicle Dynamics" – subject to the passing of a final examination consisting in the presentation and discussion of a thesis

#### ART. 6 - PROFESSORS

Lessons on the Masters course will be held by University of Pavia professors, as well as highly-qualified experts.



# UNIVERSITÀ DEGLI STUDI DI PAVIA

Servizio Qualità della Didattica e Servizi agli Studenti

## ART. 7 – ADMISSION REQUIREMENTS

To be admitted to the Masters course, candidates must possess at least a three-year degree, awarded in Italy or overseas, in one of the following qualifications or their equivalent:

**1. Three-year diploma pursuant to Ministerial Decree 270/2004, in one of the following classes:**

- Industrial Engineering - L-9  
courses including the following orientations: mechanical engineering, aerospace, electrics, energetics, mechatronics, vehicle engineering, industrial engineering and materials

**2. Three-year degree pursuant to Ministerial Decree 509/1999, in one of the following classes:**

- Industrial Engineering - 10  
courses including the following orientations: mechanical engineering, aerospace, electrics, energetics, mechatronics, vehicle engineering, industrial engineering and materials

**3. Masters degree pursuant to Ministerial Decree 270/04, in one of the following Engineering classes:**

- Mechanical engineering - LM-33
- Aerospace and Astronautics - LM-20
- Electrics - LM-28
- Energetics and Nuclear - LM-30
- Science and Engineering of Materials - LM-53
- Automations - LM-25

**4. Masters degree pursuant to Ministerial Decree 509/99, in one of the following Engineering classes:**

- Mechanical engineering - 36/S
- Aerospace and Astronautics - 25/S
- Electrics - 31/S
- Energetics and Nuclear - 33/S
- Science and Engineering of Materials - 61/S
- Automations - 29/S

**5. Degree awarded pursuant to the regulations previously in force:**

- Mechanics engineering
- Industrial engineering
- Aerospace engineering
- Electric engineering
- Nuclear engineering
- Materials engineering

The maximum number of enrolments is **20**.

The minimum number of enrolments to activate the course is **15**.

The Teaching Board may evaluate whether the conditions exist to broaden intake.

If the number of candidates who meet the admission requirements, exceeds the maximum number foreseen, a ranking list will be drawn up by a commission composed of the Masters Co-ordinator and two Masters professors. Scores will be awarded to a maximum of 100, based on the following criteria:

1. Up to a maximum of 30 points for the graduation mark relevant to the study title allowing candidate's entrance, thus subdivided:
  - 10 points for graduation mark < to 100/110
  - 11-21 points for graduation mark from 100/110 to 110/110 (11 points are assigned to the grade of 100/110 and the total score is increased by one point for each additional 110<sup>th</sup> awarded)
  - 30 points for graduation mark of 110/110 with honours



# UNIVERSITÀ DEGLI STUDI DI PAVIA

Servizio Qualità della Didattica e Servizi agli Studenti

2. Up to a maximum of 70 points for an interview, that may be held in Italian or English, designed to evaluate candidates' knowledges, skills and determination to pursue the study course with regards to Masters specific contents and objectives. The pass mark for the interview is 42/70.

In instances where candidates have the same score, the younger candidate will prevail.

In cases in which one or more candidates withdraw, the available places will be offered, in order of merit, to candidates who appear on the ranking list.

## **ART. 8 - APPLICATIONS AND DEADLINES**

Candidates must send the admission form, adhering to the methods established in the call for applications, from **18 July 2017 to 1<sup>st</sup> September 2017**.

## **ART. 9 – FEES AND CONTRIBUTIONS**

### **Enrolment:**

Candidates enrolling for the Masters course should, for the **2017/2018** academic year, pay the sum of **€15.000** that is inclusive of the **€16,00** revenue stamp, **€142,00** "Administrative Expenses".

The amount of **€15.000** must be paid in a single instalment upon enrolment.

### **Final test:**

To be admitted to the final test, candidates must present a dedicated admission form bearing a €16.00 revenue stamp and pay the sum of €100.00<sup>1</sup> (of which €16.00 is a revenue stamp paid virtually on the parchment) for the issue of the parchment.

### **Subsidies:**

National or overseas organisations or individuals may contribute to the running of the Masters course through financing, partially or in full, the registration fee.

In such instances, the Director of the Department of Industrial Engineering and Information Technology will sign relevant sponsorship agreements and candidates will be selected based on criteria established by the Teaching Board and published on the website of the administration office organising the Masters course.

## **ART. 10 – WEBSITE OF THE ADMINISTRATION OFFICE ORGANISING THE MASTERS COURSE, REFERRED TO IN ARTICLE 8 OF THE CALL FOR APPLICATIONS**

All correspondence to candidates will be published on the following website:

[http://iii.unipv.it/index\\_en.php?pag=teaching/master.html](http://iii.unipv.it/index_en.php?pag=teaching/master.html)

<http://academy.quattroruote.it/it/master/2017/master-vehicle-dynamics1.html>

**For information regarding course organisation, please contact:**

### **MASTERS ADMINISTRATION OFFICE**

Department of Industrial Engineering and Information Technology

Prof. Carlo E. Rottenbacher, Ms Laura Pecoraro

Tel. 0382/6992200

Fax 0382/6992228

E-mail: masteruniversitario@quattroruote.it

MS/EA/cg/sb

<sup>1</sup> Payments must be made by MAV (payment against notice) by following the procedure described for the payment of the admission fee. Please be aware that the Administrative Board may decide to vary this sum after the publication of this call for applications.