UNIVERSITÀ DI PAVIA

Servizio Post Laurea

ATTACHMENT 1

Sommario

Art. 1 – Tipology 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 ELECTRICAL, COMPUTER AND BIOMEDICAL ENGINEERING** for the 2022/2023 academic year. The course takes advantage of the educational, logistic and organizational collaboration of ASC S.r.l. (Quattroruote Automotive Safety Centre).

Edition: 4

Disciplinary area: SCIENTIFIC-TECNOLOGICAL AREA

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 CarRealTime, MSC Adams and software CFD **simulator**, **a special module of training on static simulator** and a **working session on 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.

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** (a total of 1500 hours and 60 CFU) and is divided into: lectures at the University of Pavia (Faculty of Engineering and in the Vistarino building) and ASC - Safe Driving Center (Vairano di Vidigulfo, PV) practical exercises at ASC - Centro di Guida Sicura (Vairano di Vidigulfo, PV), technical visits to course facilities, final internship at partner companies, seminars, study activities, preparation and individual training.
The start of the Master's lessons is expected in November 2022.

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, University of Padova, Stanford 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.

Unique and very innovative seminars and workshop will be offered:

1. **Theoretical and practical seminar on ADAS systems** (*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 Overunnable 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

Each individual teaching credit corresponds to 25 hours that will be assigned to the activities of lectures, practical exercises, group work, seminars, study and research activities for the writing of the thesis and individual preparation. The hours will be distributed according to the following predefinite distributions:

Lectures Hours	10
Study Hours	15

or

Lectures Hours	2
Study Hours	15
Exercises, practical activities Hours	8

The Master's course, mainly addressing an international target, based on the number and nationality of students enrolled, can be delivered in English. Some lessons can be delivered online.

The Teaching Modules are organized as follows:

Module	Year	SSD	Lenguage	L(h)	STD(h)	DAD(h)	EX(h)	Tot(h)	CFU
Design of the Vehicle Dynamics	**I**								
1) Total Vehicle Design		ING-IND/13 | MECCANICA APPLICATA ALLE MACCHINE	English	60	90	0	0	**150**	**6**
		Contents: • 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.							
2) Fundamental Driving Dynamics		ING-IND/13 | MECCANICA APPLICATA ALLE MACCHINE	English	40	60	0	0	**100**	**4**
		Contents: • 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.							

3) Virtual Dynamics Design and Simulation	ING-IND/13 | MECCANICA APPLICATA ALLE MACCHINE	English	8	60	0	32	**100**	**4**
	Contents: • Multibody analyses introduction • Adams Car. Real-time analyses • From real-time virtual Dynamics to Dynamic driving simulator.							
Materials, Propulsion and Control **I**								
4a) Materials	ING-IND/21 | METALLURGIA	English	20	30	0	0	**50**	**2**
	Contents: • Materials for the Automotive sector • Technologies, Processes • Features.							
4b) Structural resistance	ICAR/08 | SCIENZA DELLE COSTRUZIONI	English	20	30	0	0	**50**	**2**
	Contents: Methods of topological optimization for verifying the body and components.							
5a) Propulsion: ICE.	ING-IND/08 | MACCHINE A FLUIDO	English	10	15	0	0	**25**	**1**
	Contents: • Internal combustion engines • Principal characteristics and features • Architecture • Consumption.							
5b) Propulsion: Hybrid, Electric	ING-IND/32 | CONVERTITORI, MACCHINE E AZIONAMENTI ELETTRICI	English	10	15	0	0	**25**	**1**
	Contents: • Electric Motors • Generators • Accumulation Systems • Power supply • Recharging • Connection Systems • Wiring • Protocols • Diagnostics.							
6) Vehicle Dynamic Control	ING-INF/04 | AUTOMATICA	English	10	15	0	0	**25**	**1**
	Contents: • Introduction to the main regulators • Braking control systems, stability, traction, and vector control • Classical problems • Vehicle dynamic control Measurements, sensors and observers.							

Vehicle Testing and Pilot/Vehicle Interaction	**I**								
7) Total Vehicle Testing and Development		ING-IND/13 | MECCANICA APPLICATA ALLE MACCHINE	English	12	90	0	48	**150**	**6**
		Contents: • 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.							
8) Human/vehicle interaction		ING-IND/34 | BIOINGEGNERIA INDUSTRIALE	English	14	105	0	56	**175**	**7**
		Contents: • 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.							
							PARTIAL	**850**	**34**
Internship/Stage		English						**600**	**24**
Final Exam								**50**	**2**
							TOTAL	**1500**	**60**
L *Lectures;* **STD** *Study;* **DAD** *Online lessons;* **EX** *Exercises, practical activities.*									

Students attendance of the various training activities is compulsory for at least 75% of the total number of hours. The training period may not be suspended.
Transfers to similar Master's degrees at other universities are not allowed.

Art. 4 – In-course assessments

Learning is assessed during the course, by the teachers who hold the lessons and exercises, carry out the seminars and practical tests and follow the work of the students. 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 consist in the presentation and discussion of a written thesis on the internship carried out by the students.

At the end of the Master, participants who have carried out all the activities and fulfilled the obligations, upon passing the finale exam will be awarded the Diploma of University Master of FIRST level 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 a degree in accordance with DD.MM. (Ministerial decrees) 509/99 and 270/04:

- (2009) L-9 | Class of degrees in Industrial engineering

Degree in accordance with the previous regulations

- LT | 10 | Class of degrees in Industrial engineering

Withing the above degree classes, the following qualifications will be preferential:

- Mechanical engineering;
- Electrical engineering;
- Industrial engineering;
- Nuclear engineering;
- Aerospace engineering;
- Materials engineering.

Moreover the following academic titles belonging to classes of degrees in accordance with DD.MM. 509/99 and 270/04, will be evaluated:

- Aerospace and Aeronautical engineering – 25/S, LM-20;
- Automation engineering – 29/S, LM-25;
- Electrical engineering – 31/S, LM-28;
- Energy and nuclear engineering – 33/S, LM-30;
- Mechanical engineering – 36/S, LM-33;
- Material sciences and engineering – 61/S, LM-53.

In case of application for admission by students with an academic degree obtained abroad, the Academic Board will evaluate the equivalence of the qualification with an Italian qualification suitable for admission to the Master's degree.

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

The **minimum number** of participants to activate the course is **7**.

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. The interview is considered passed 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. In the event of the resignation of one or more candidates, the available places will be made available again according to the ranking of merit, fino to exhaustion of the places themselves.

Auditors

Some companies have expressed the interest to involve, for a fee, their employees in individual modules of the Master. Therefore for this edition it is planned to admit to the course some professionals as auditors.
Auditors, **business partner program employees or professionals**, must have proven experience in the automotive industry and can participate in up to 5 modules.

The cost of the modules including € 32.00 (stamp duty) and € 142.00 (secretarial fees), is divided as follows:

- Module 1 (60 hours, classroom) - € 3,500;
- Module 2 (40 hours, classroom) - € 2,500;
- Module 3 (40 hours, classroom) - € 2,500;
- Module 7 (60 hours: ASC driving course + ASC Vairano track activity) - € 7,174;
- Module 8 (70 hours, classroom and experimental) - € 4,000.

The activities of module 7 take place exclusively on the ASC slope in Vairano.

Art. 8 – Deadline for admission application

Applicants must submit their application for admission in accordance with the procedures, set out in the Call for Admission, **from 24 June 2022 and by the deadline of 21 September 2022.**

Art. 9 – Attachments to the online application

Candidates must attach, during the online application procedure to the Master, the scan of the following documentation:

1) **application form** (the form to be used is on page 9);
2) front-rear of the **personal identification document** inserted during registration**;**
3) **self-declaration** of the passed exams during the academic career reading relevant marks (only for whom have an Italian academic title);
4) in the case of a foreign academic title:
   a) **Academic qualification** required for admission in Italian or English;
   b) **"Declaration of value"** issued by the Italian Embassy/Consulate in the State where the academic title had been released (only if already available);
   c) **Degree certificate** in Italian or English with the taken exams and the relative marks (**transcript of records**);
   d) 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;
5) **reference letter**;
6) **motivational letter**;
7) **curriculum vitae** listing also professional experiences in working environments pertaining the above Master, if any.

Please note that as indicated in Article 3 of the Call for Admission, applicants holding a qualification obtained abroad **must deliver**, **before the enrolment deadline or at least by 11 January 2023, the original versions of the required and uploaded documentation together with a declaration of legal validity by the Italian Embassy/Consulate in the State where the academic title had been released**, to Ufficio Master - Servizio Post Laurea - via Ferrata 5, 27100 Pavia.

The admission requirements must be met 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 2023**.

Final exam:
To be admitted to the final exam, candidates must submit a **specific application form** along with the payment of **€ 116.00**[1] 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

The **Organizational Secretary** will be located at:
Dipartimento di Ingegneria Industriale e dell'Informazione
Via A. Ferrata, 5 - 27100 Pavia (PV)
T: 0382/69.92.201
E: info.vehicledyn@unipv.it
The reference contacts are: Prof. Carlo E. Rottenbacher - Sig.ra Laura Pecoraro

The website of the secretary is:
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.

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-rear 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:

   a) Academic qualification required for admission in Italian or English;

   b) "Declaration of value" issued by the Italian Embassy/Consulate in the State where the academic title had been released (only if already available);

   c) Degree certificate in Italian or English with the taken exams and the relative marks (transcript of records);

   d) 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 ……