ATTACHMENT EN-24-DISS-M1-311

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Art. 1 - Typology of course

The University of Pavia has activated a first-level Post-bachelor Vocational Program in '**Car Test Driving and Simulation for Vehicle Dynamics Development**' at the **DEPARTMENT OF INDUSTRIAL AND INFORMATION ENGINEERING**, for the 2024/2025 academic year.

Edition: 4

Disciplinary area: SCIENCES AND TECHNOLOGY

Art. 2 - Educational aims, professional opportunities and course appeal

The Post-bachelor Vocational Program in (formerly named as '**Design and Development of Vehicle Dynamics**') **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 the students **in different techniques of vehicle testing, both virtually**, by means of CAE systems, in particular using 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 and specifically oriented to the design and evaluation of vehicle behaviour, which will be the focus of the teaching modules on testing at track and with the simulator.

The Vocational Program **is supplemented by targeted training to the use of a** specific software like **CarRealTime** (VI-Grade **compact static simulator**), **MSC Adams**, **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 Vocational Program **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 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 Vocational Program, 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, CSI, McLaren, Pirelli, CD Adapco/Siemens, Seat, Thyssen Presta, AudiSport, ZF-TRW, Ycom, Brembo, Lamborghini, Continental, Prema, Trident, ADM Motorsport, Team Lazarus, JAS Motorsport, Tatuus, Autotecnica Motori, Maserati, Alfa Romeo, Magneti Marelli, FCA, Abarth, Michigan Scientific, Michelin, Oreste Berta, PCB, Kistler, Danisi Engineering, Skydrive, Harp Racing, Corbetta Racing, PetriCorse, Imperiale Racing, Leomax, Porsche NTC, Leane.

The current context of deep evolution in the *automotive* and *motorsport* sector can find a way to relaunch also thanks to the acquisition of highly trained human resources from not only 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 Vocational Program.

Art. 3 - Programme

The Vocational Program has a duration of **1 year** and provides a total of 1,500 hours, divided according to the table below.

All the training activities provided correspond to the acquisition, by the students, of **60** university credits (CFU).

The teaching modules are organized as follows and will be **taught in English**:

Module	SSD	Lenguage	L(h)	STD(h)	OL(h)	EX(h)	Tot(h)	CFU
DESIGN OF THE VEHICLE DYNAMICS								

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.							
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.							
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.							
MATERIALS, PROPULSION AND CONTROL								
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								

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	**204**	**510**	**0**	**136**	**850**	**34**
Internship/Stage		English					**600**	**24**
Final exam		English					**50**	**2**
						TOTAL	**1500**	**60**
L ***Lectures;*** **STD** ***Study;*** **OL** ***Online lessons;*** **EX** ***Exercises, practical activities.***								

Lectures and seminars will be held by researchers from the University of Pavia or 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, Kistler, PCB, Leane.
There will be **technical visits** to the *Balocco* (FCA) *experimental center*, the *Driving Simulator Center* of Danisi Engineering, the *CSI center* and the *Pirelli laboratories*.

Very innovative seminars and workshops will be offered, such as:

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** oriented to vehicle dynamics, *durability* and comfort.

Students of the Vocational Program will also be able **to participate**, free of charge, **in any seminars/workshops/events of similar themes**, organized by the Coordinator, within the relevant Department.

The training period may not be suspended.

Transfers to similar Vocational Programs at other universities are not allowed.

Art. 4 - Assessment of ongoing learning

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 exam and achievement of qualification

The final exam will consist in the **presentation and discussion of a written thesis** on the internship carried out by the students; it does not imply the attribution of a mark.

At the end of the Vocational Program, participants who have carried out all the activities and fulfilled the obligations, upon passing the final exam will be awarded the **first-level Post-bachelor Vocational Program's Diploma in 'Car Test Driving and Simulation for Vehicle Dynamics Development'**.

Art. 6 - Faculty

Teaching will be held by faculty from the University of Pavia, and from other universities e as well as by highly-qualified professional experts.

Art. 7 - Admission requirements

The Vocational Program is aimed at those who have obtained a Bachelor's Degree, pursuant to D.M. n. 270/04, in one of the following classes:

- (L-9) Industrial Engineering Degree Class

The Vocational Program is aimed, also, at those who have obtained a Bachelor's Degree, pursuant to D.M. n. 509/99, in one of the following classes:

- (10) Industrial Engineering Degree Class

and degrees in accordance with the previous regulations.

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.

The maximum number of places available is **14**.

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

The Academic Board will also be able to assess whether the conditions for expanding the maximum number of participants are met.

Should the number of applicants exceed the maximum number allowed, a Commission composed of the Coordinator and two Faculty members will make a selection and formulate a merit ranking, 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 Vocational Program. Special recognition will be given for any work experience in the *automotive* sector – such as scientific publications related to the topic area of the Vocational Program – 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 equal merits, young age will prevail in the ranking. In case of withdrawal of one or more candidates, the vacant place/places will be made available to the next candidate in the ranking, up to the coverage of all available places.

AUDITING CLASSES

Admission to auditing classes is subject to the following criteria:

Auditors, **business partner program employees or professionals**, must have proven experience in the *automotive/motorsport* 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 at the ASC proving ground in Vairano.

Auditors will receive a **certificate of attendance** related to the attended modules.

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 **31/05/2024** and by the deadline of **30/09/2024**.
The requirements of the Call fo admission and this Attachment, must be held by the deadline for application.

Art. 9 - Attachments to upload for the admission application

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

1) **application form** (the form to be used is on page 8)
2) front-rear of the **personal identification document** inserted during registration
3) **reference letter**
4) **motivational letter**
5) **curriculum vitae** listing also professional experiences in working environments pertaining the above Vocational Program, if any.

Only for whom have an Italian academic title:
6) **self-declaration of the passed exams** during the academic career reading relevant marks

Only for whom achieved a foreign academic title:

6) **academic qualification** required for admission in Italian or English (parchment or certificate)
7) "**Declaration of value**" **(DoV)** issued by the Italian Embassy/Consulate in the State where the academic title had been released (only if already available)

As an alternative to the "Declaration of value", the University recognizes the following documents as valid:

- ***Diploma supplement*** *(if the admission qualification to the Vocational Program is issued by a European University)*
- **Certificate of comparability** *issued by Naric/Cimea*

8) **degree certificate** in Italian or English with the taken exams and the relative marks (**transcript of records**).

Please note that, as indicated in art. 3 of the Call for Admission to the Vocational Program, **applicants holding a qualification obtained abroad** must, **by the deadline of the enrollment window or at least by 10/01/2025**, **deliver at the Servizio Post Laurea** - Ufficio Master (via Ferrata n. 5 Pavia) **the uploaded documentation in original accompanied by legalization** of the Italian Representation competent for the territory in the country to which the institution that issued the title belongs.

Art. 10 - University tuition and fees

Enrolment

For the l'a.a. 2024/25, those enrolled in the course must pay the sum of **€ 15.000,00**, inclusive of: € 16,00 (stamp duty tax) € 142,00 (Administrative fees).

This amount must be paid in **2 instalments:**
- 1° instalment of € **10,000.00**, to be paid **upon enrolment**
- 2° instalment of € **5.000,00**, to be paid by **10** of **January 2025**.

Bodies or national/international subjects can contribute to the functioning of the Vocational Program by providing scholarships aimed to enrollment/internships attendance. In the event of finalization of the aforementioned agreements, they will be publicized on the relevant website with the eventual award criteria.

Final exam

In order to be admitted to the final exam, candidates must submit a specific application form along with the payment of 116,00 as a fee for the issuance of the Vocational Program's Diploma (including n° 2 stamp duty tax of 16,00 paid virtually: one for the parchment and one for the application). The cost of the parchment could be updated by resolution of the Board of Directors after the publication of this notice.

Art. 11 - Web site and Organizational Secretary

Any communication and important information regarding candidates and students will be published on the following website:
http://vehicledynamics.unipv.it

For information regarding the course organization:

Organizational Secretary

The Organizational Secretary will be located at:

Dipartimento di Ingegneria Industriale e dell'Informazione
Via A. Ferrata, 5 - 27100 Pavia (PV)
E: info.vehicledyn@unipv.it
P: 0382.6992201

The contact persons are: Prof. Carlo E. Rottenbacher - Sig.ra Laura Pecoraro (ASC).

UNIVERSITÀ DI PAVIA

Servizio Medicina
e post laurea

APPLICATION FORM

to I level POST-BACHELOR VOCATIONAL PROGRAM:

CAR TEST DRIVING AND SIMULATION FOR VEHICLE DYNAMICS DEVELOPMENT

(this form, duly filled in, must be uploaded in the on-line procedure of admission to the Post-bachelor Vocational Program 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 Post-bachelor Vocational Program

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) **reference letter**

3) **motivational letter**

4) **CV** listing also professional experiences in working environments pertaining the above course, if any

Only for whom have an Italian academic title:

5) **self-declaration of the passed exams** during the academic career reading relevant marks

Only for whom achieved a foreign academic title:

5) **academic qualification required** for admission, in Italian or English

6) "**Declaration of value**" **(DoV)** issued by the Italian Embassy/Consulate in the State where the academic title had been released (only if already available)
   As an alternative to the "Declaration of value", 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*

7) **degree certificate**, in Italian or English, with the taken exams and the relative marks (**transcript of records**).

Date …… Signature ……