# ATTACHMENT EN-24-DISS-M1-310

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## Art. 1 - Typology of course

The University of Pavia has activated a first-level Post-bachelor Vocational Program in '**Race Engineering**' at the **DEPARTMENT OF INDUSTRIAL AND INFORMATION ENGINEERING**, for the 2024/2025 academic year.

***Edition:*** 6

***Disciplinary area:*** SCIENCES AND TECHNOLOGY

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

The Post BA Vocational Program **aims to train highly qualified professionals with a solid preparation in managing racing cars**. **Specific competence will be gained** by the students in the **techniques for car set up in a virtual environment** through CAE, as well as through **dedicated experimental testing sessions on the track**, during the entire duration of the program, with a Formula 4 car driven by professional drivers. The learning environment **is highly innovative** and includes classroom lessons along with **test sessions on the ASC's proving ground of Quattroruote** and the Skydrive simulation sessions at the Monza Circuit, during which students will have **hands-on learning** of the techniques and methodologies of Race Engineering activities (from race car management to radio communications to the psychological aspects involving the relationship between the driver and the team). All participants will follow an introductory course in advanced driving techniques specifically designed for the program. Another unique and fundamental feature of the Race Engineering Vocational Program is the long lasting interaction with professional Race Engineers for the entire length of the program.

The training program ends with **targeted training on specific software** like **CarRealTime** (VI-Grade compact static simulator), **MSC Adams**, **Cradle CFD software**, **AIM Race Studio 3**, **Atlas** and with **a specific training module** on the **SkyDrive dynamic simulator** at the Monza Circuit.

**Career opportunities** for graduates **involve racing teams and engineering companies active in motorsport competitions in Europe and the world**. More specifically, the competencies acquired from the Vocational Program represent a key factor in permitting students to become part of a racing team quickly and successfully. At present, this type of engineering professional, strongly requested by the market, is not associated with any specific academic program.

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, 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) Vehicle Dynamics Fundamental | ING-IND/13 \| MECCANICA APPLICATA ALLE MACCHINE | English | 60 | 90 | 0 | 0 | **150** | **6** |
| | **Contents:**<br>• Fundamentals of vehicle dynamics<br>• Aerodynamics<br>• Tires. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2) Virtual Dynamics Design and Simulation | ING-IND/13 \| MECCANICA APPLICATA ALLE MACCHINE | English | 8 | 60 | 0 | 32 | **100** | **4** |
| | **Contents:**<br>• Multibody analyses introduction<br>• Adams Car<br>• Real-time analyses<br>• From real-time virtual Dynamics to Dynamic driving simulator. | | | | | | | |
| 3) Driving Simulator Training | ING-IND/13 \| MECCANICA APPLICATA ALLE MACCHINE | English | 8 | 60 | 0 | 32 | **100** | **4** |
| | **Contents:**<br>• Experimental training with static driving simulator. | | | | | | | |
| **PROPULSION AND CONTROL** | | | | | | | | |
| 4a) Propulsion: ICE | ING-IND/08 \| MACCHINE A FLUIDO | English | 10 | 15 | 0 | 0 | **25** | **1** |
| | **Contents:**<br>• Internal combustion engines<br>• Principal characteristics and features<br>• Architecture<br>• Consumption. | | | | | | | |
| 4b) Propulsion: Hybrid, Electric | ING-IND/32 \| CONVERTITORI, MACCHINE E AZIONAMENTI ELETTRICI | English | 10 | 15 | 0 | 0 | **25** | **1** |
| | **Contents:**<br>• Electric Motors<br>• Generators<br>• Accumulation Systems<br>• Power supply<br>• Recharging<br>• Connection Systems<br>• Wiring<br>• Protocols<br>• Diagnostics. | | | | | | | |
| 4c) Propulsion: Materials and Structural Resistance | ICAR/08 \| SCIENZA DELLE COSTRUZIONI | English | 10 | 15 | 0 | 0 | **25** | **1** |
| | **Contents:**<br>• Topological optimization<br>• Finite element analysis. | | | | | | | |
| 5) Vehicle Dynamics Control | ING-INF/04 \| AUTOMATICA | English | 10 | 15 | 0 | 0 | **25** | **1** |
| | **Contents:**<br>• Introduction to the main regulators<br>• Braking control systems, stability, traction, and vector control<br>• Classical problems, Vehicle dynamic control, Measurements, sensors and observers. | | | | | | | |
| **VEHICLE TESTING AND PILOT/VEHICLE INTERACTION** | | | | | | | | |
| 6) Advanced Driving Course | ING-IND/13 \| MECCANICA APPLICATA ALLE MACCHINE | English | 2 | 15 | 0 | 8 | **25** | **1** |
| | **Contents:**<br>• Driving experience and training. | | | | | | | |
| 7) Skydrive Dynamic Simulator | ING-IND/13 \| MECCANICA APPLICATA ALLE MACCHINE | English | 10 | 15 | 0 | 0 | **25** | **1** |
| | **Contents:**<br>• Simulation of race track activities propaedeutic to the final examination. | | | | | | | |
| 8) Race Track Management and Vehicle Set Up for Performance | ING-IND/13 \| MECCANICA APPLICATA ALLE MACCHINE | English | 18 | 135 | 0 | 72 | **225** | **9** |
| | **Contents:**<br>• Basic knowledge and tools evaluation<br>• Manuals and regulations<br>• Methodology for an effective racing car setting<br>• Analyses of Track tests. | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9) Race Engineering Science | ING-IND/13 \| MECCANICA APPLICATA ALLE MACCHINE | English | 10 | 15 | 0 | 0 | **25** | **1** |
| | **Contents:**<br>• Every day task and performance evaluation<br>• Development of a methodology to 'read driver's mind'<br>• Team building. | | | | | | | |
| 10) Data Acquisition | ING-IND/12 \| MISURE MECCANICHE E TERMICHE | English | 8 | 60 | 0 | 32 | **100** | **4** |
| | **Contents:**<br>• Data acquisition systems<br>• Data analysis<br>• Transducers and sensors<br>• Experimental training. | | | | | | | |
| 11) Biomechanics: Driver/Vehicle interaction | ING-IND/34 \| BIOINGEGNERIA INDUSTRIALE | English | 20 | 30 | 0 | 0 | **50** | **2** |
| | **Contents:**<br>• Methodology and tools for the evaluation of driver/vehicle interaction<br>• Comfort and features<br>• Integrated system of measurement and monitoring<br>• Driver physiology<br>• Psychophysical stress and physiological adaptation<br>• Environmental factors. | | | | | | | |
| | | **PARTIAL** | **184** | **540** | **0** | **176** | **900** | **36** |
| **Internship/Stage** | | English | | | | | **550** | **22** |
| **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 VI-grade, Pirelli, MegaRide, Danisi Engineering, McLaren, CD Adapco/Siemens, MSC Adams, Ycom, Brembo, Porsche, AudiSport, JAS Motorpsort, Tatuus, Autotecnica Motori, SkyDrive, Regolo Studio, Haas F1 team, Leane. There will be **technical visits** to 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. **Experimental seminar on vehicle dynamics** designed in collaboration with Tatuus/Pirelli
2. **Seminar on experimental aerodynamics**
3. **Seminar on vehicle instrumentation**.

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 'Race Engineering'**.

## 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).

[illegible]

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

La persona di riferimento è 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:

## RACE ENGINEERING

(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 ……