MAGISTRALMENTE VIRTUAL FAIR MASTER'S

1 FEBRUARY 2023

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Mechanical Engineering For Sustainability

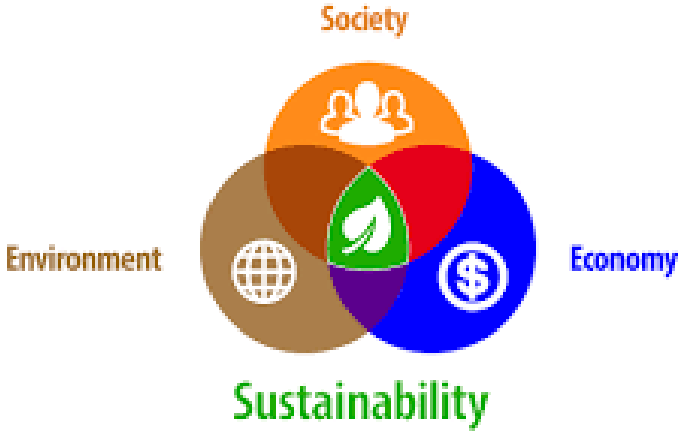
Why sustainability?

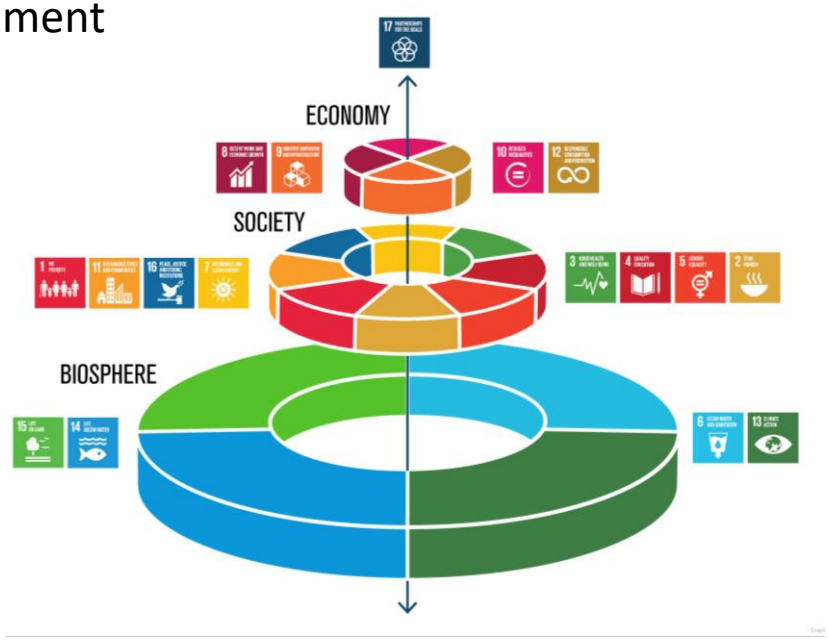
Globalization brought several challenges and opportunities.

The common wisdom is that only sustainable development leads to 'stable and lasting prosperity, now and into the future': this is what brought the UN to adopt the Sustainable Development Goals paradigm.

The severity and magnitude of the challenges before us require accelerated global-scale action that is committed to and follows the SDG pathway (SDG report, 2022).

Environment, Economy and Society are the foundations of sustainable development





Are mechanical engineers part of the equation?

YES, but they need a specific, updated and multidisciplinary education

The Course of Study in Mechanical Engineering for Sustainability

This is the origin of the international Course of Study in Mechanical Engineering for Sustainability (MES). The course is based on three pillars:

Internationalization

Sustainability

Interdisciplinary Applications

Internationalization

Why an international course?

- The **market** of companies hiring mechanical engineers **is global**
- The **cultural exchange** between international students is an added value
- Graduates will **master technical English**

Why Forlì Campus?

- Well established **community of international students and teachers**
- Positive interactions with **other international courses offered in the Campus**
- Possible synergies with the Master in **Aerospace Engineering** (elective courses, students projects, etc.)

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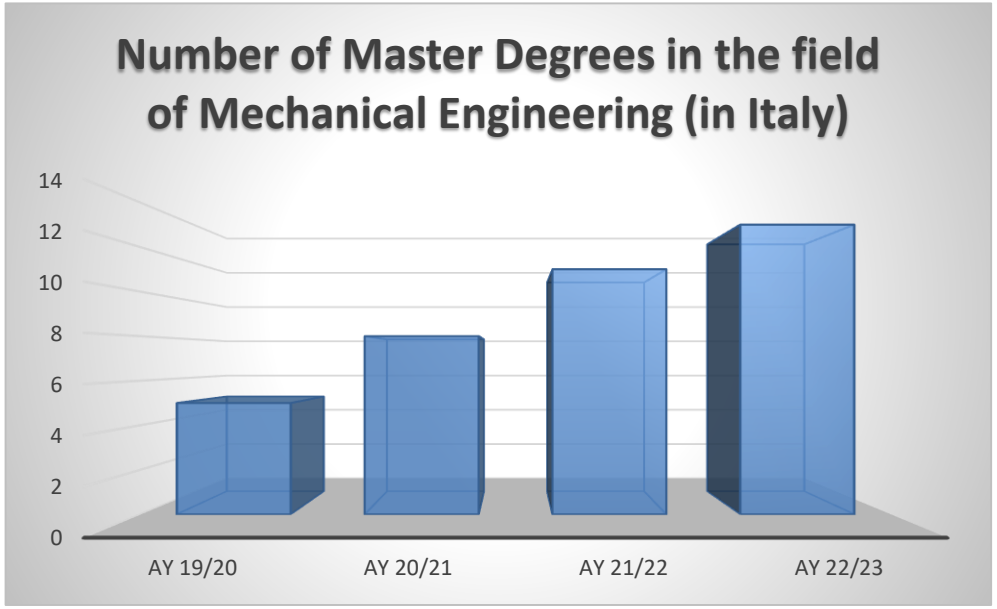
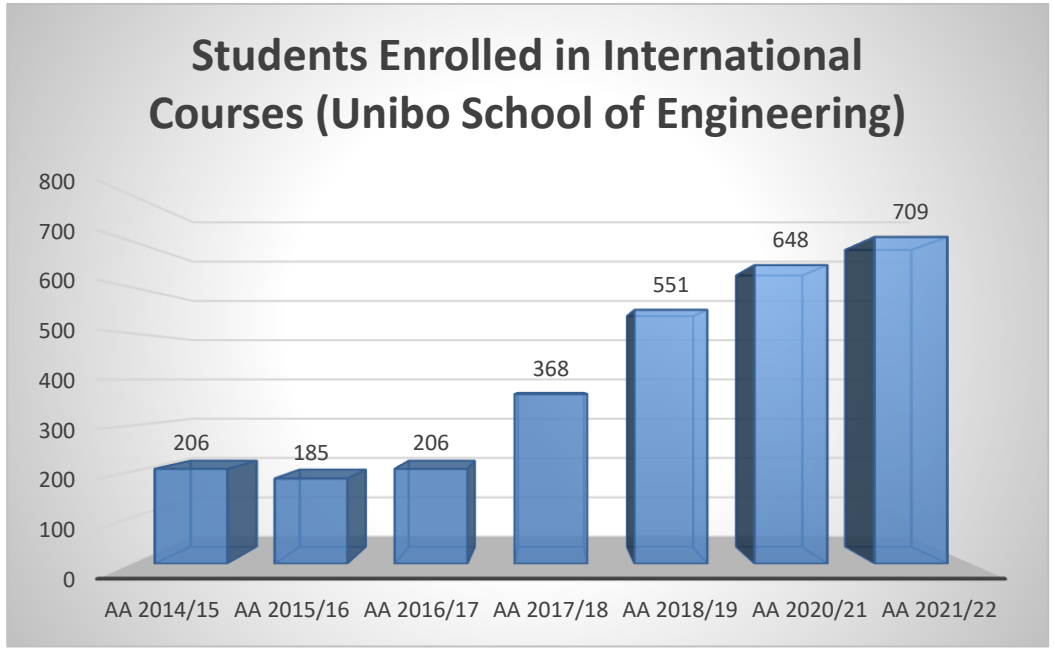
Internationalization

Why studying Mechanical Engineering in English?

- Mechanical Engineering in Italy is going international!





- Students know that in the future they will work in an international scenario: the number of students enrolled in international Courses of Studies is steadily increasing at the School of Engineering (University of Bologna)

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Sustainability

What do we mean by Sustainable Development?

- "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Brutland Commission, 1987)

How can we contribute, as mechanical engineers?

- The manufacturing Industry has a relevant role:
- Consumer goods life cycle/end of life
- Products design and materials
- Technological processes
- Production systems
- Machines and plants

Sustainability

What do we mean by Sustainable Development?

"meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Brutland Commission, 1987)

How can we contribute, as mechanical engineers?

Awareness and technical competence are essential. Common sense doesn't always work, and sustainability assessment dynamically change with the evolution of the production process.

An example:

Do you think a paper cup is more sustainable than a plastic one?

It is (partially) biodegradable, but its production requires a higher amount of energy and water

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Interdisciplinary Application-Oriented Education

Is it just a matter of learning by doing?

We know how important the learning by doing approach is in engineering. But that's just the last mile. Students also need to acquire an interdisciplinary approach to engineering problems, they need to know industrial case studies, and the companies' workflow.

MES offers an Interdisciplinary Application-oriented education, thanks to the following key features:

- Involvement of companies in the didactics, through seminars, plants visits, case studies presented during lectures
- Interdisciplinary lab courses, where engineering problems are addressed from different perspectives
- A steering committee populated by companies' representatives assures that education fulfills the marked requirements

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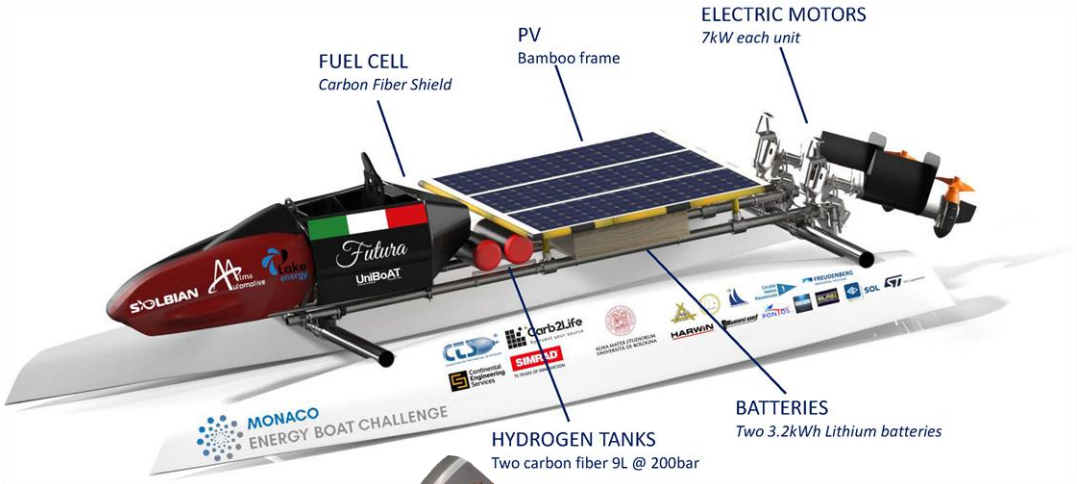
Mechanical Engineering for Sustainability

So, in the end, why Mechanical Engineering for Sustainability?

- Because design, production, technologies, plants and, generally speaking, everything is up to mechanical engineers is going to be looked over, wearing the glasses of sustainability. This is not happening in Forlì, its worldwide. And there is no going back.
- In the future there will not be alternatives to sustainable manufacturing industry. We are actually working to cancel the word ‘Sustainability’ from the name our Course of Study, since in the future mechanical engineering will be intrinsically sustainable.



[Entro il 2026 serviranno 4 milioni di lavoratori con competenze green: i profili necessari a gestire il cambiamento - Innovation Post]

Mechanical Engineering for Sustainability

Course Structure

- First Year: 57 ECTS
  - 51 ECTS → 6 required courses
  - 6 ECTS → 1 elective course

Required Courses (51 ECTS)

Elective Course (6 ECTS)

- Second Year: 63 ECTS
  - 18 ECTS → 3 required courses, depending on the chosen guided choice
  - 6 ECTS → 1 required course
  - 12 ECTS→ 2 elective courses
  - 12 ECTS→ interdisciplinary labs / learning by doing activities
  - 15 ECTS→ thesis/internship

Guided Choice Courses (18 ECTS)

Required Course (6 ECTS)

Elective Courses (12 ECTS)

Interdisciplinary Laboratories (12 ECTS)

Final Project/Internship (15 ECTS)

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Mechanical Engineering for Sustainability

Course Structure Diagram: first year

- First Year
  - Required Courses (51 ECTS)
    - First semester (27 ECTS)
      - Engineering Design (12 ECTS)
      - Machines and Sustainable Energy Systems (9 ECTS)
      - Mathematical Models for Industrial Engineering (6 ECTS)
    - Second Semester (24 ECTS)
      - Mechanical Plants and Industrial Logistics (9 ECTS)
      - Mechanics and Dynamics of Machines (9 ECTS)
      - Electric Energy Conversion (6 ECTS)
  - Elective Courses (6 ECTS)
    - First Semester
      - Experimental Fluid Dynamics (6 ECTS)
      - Numerical Analysis (6 ECTS)
    - Second Semester
      - Theory of Systems and Control for Automation (6 ECTS)
      - Materials Chemistry (6 ECTS)

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Mechanical Engineering for Sustainability

Course Structure Diagram: second year

- Second Year
  - Required Course (6 ECTS)
    - First semester
      - Advanced and Sustainable Manufacturing (6 ECTS)
  - Guided Choice (18 ECTS)
    - First Semester
      - Sustainable Automation
      - Sustainable Energy and Industry
      - Sustainable Design and Manufacturing
  - Elective Courses (12 ECTS)
    - First Semester
    - Second Semester
  - Interdisciplinary Laboratories (12 ECTS)
    - Second Semester
  - Thesis and Internship (15 CFU)
    - Second Semester

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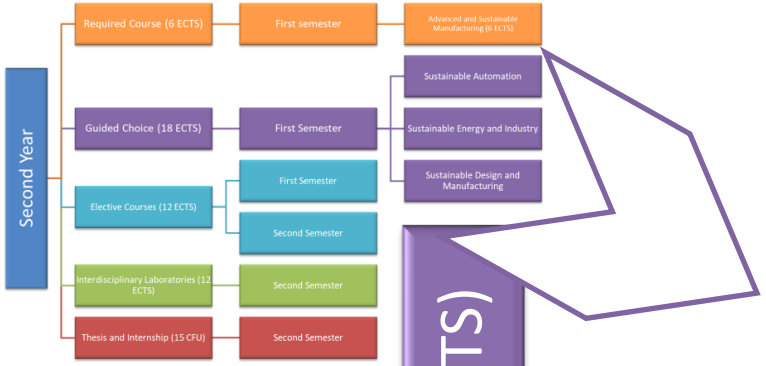
Course Structure Diagram: second year, guided choice



Guided Choice (18 ECTS)

First Semester

- Sustainable Automation
  - Technologies and Controls for Industrial Automation IC (12 ECTS)
    - Electric Drives (6 ECTS)
    - Engineering and Technology of Control Systems (6 ECTS)
  - Mechanics of Robots and Automatic Machines (6 ECTS)
- Sustainable Energy and Industry
  - Sustainable Use of Energy IC (12 ECTS)
    - Powertrains for Sustainable Mobility (6 ECTS)
    - Exergy and Pinch Point Analysis for Sustainable Energy use (6 ECTS)
  - Sustainable Design of Industrial Plants (6 ECTS)
- Sustainable Design and Manufacturing
  - Advanced Design Methods IC (12 ECTS)
    - Structural FEM Modeling Applications (6 ECTS)
    - Mechanical Design with Advanced Materials (6 ECTS)
  - Manufacturing Technologies for Composite Materials (6 ECTS)

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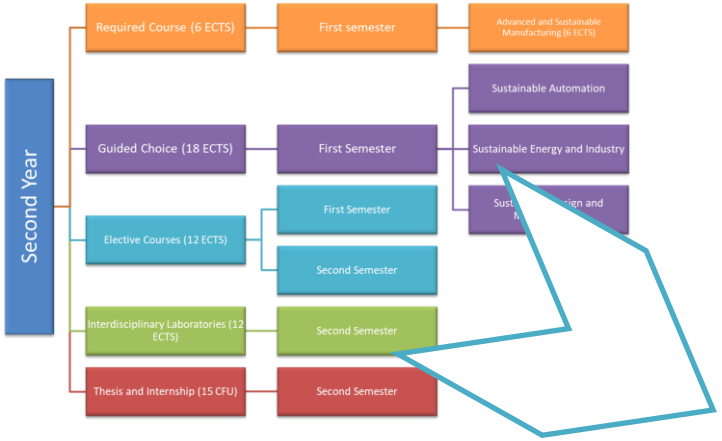
Course Structure Diagram: second year, elective courses



- Elective Courses (12 ECTS)
  - First Semester
    - Electric Drives (6 ECTS)*
    - Engineering and Technology of Control Systems (6 ECTS)*
    - Mechanics of Robots and Automatic Machines (6 ECTS)*
    - Powertrains for Sustainable Mobility (6 ECTS)*
    - Energy and Pinch Point Analysis for Sustainable Energy Use (6 ECTS)*
    - Sustainable Design of Industrial Plants (6 ECTS)*
    - Structural FEM Modeling Applications (6 ECTS)*
    - Mechanical Design with Advanced Materials (6 ECTS)*
    - Manufacturing Technologies for Composite Materials (6 ECTS)*
    - Experimental Fluid Mechanics (6 ECTS)
    - Numerical Analysis (6 ECTS)
  - Second Semester
    - Theory of Systems and Controls for Automation (6 ECTS)
    - Heating, Refrigeration and Thermal Storage (6 ECTS)
    - Modeling and Control of Sustainable Powertrains (6 ECTS)
    - Materials Chemistry (6 ECTS)

*: only courses non present in the selected guided choice can be chosen as elective courses

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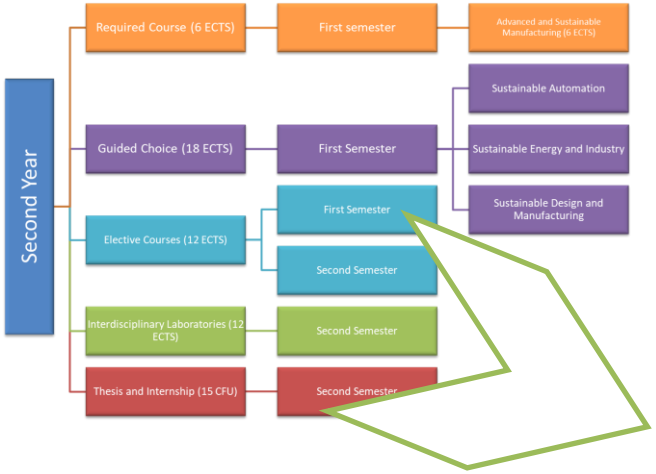
Course Structure Diagram: second year, interdisciplinary laboratories



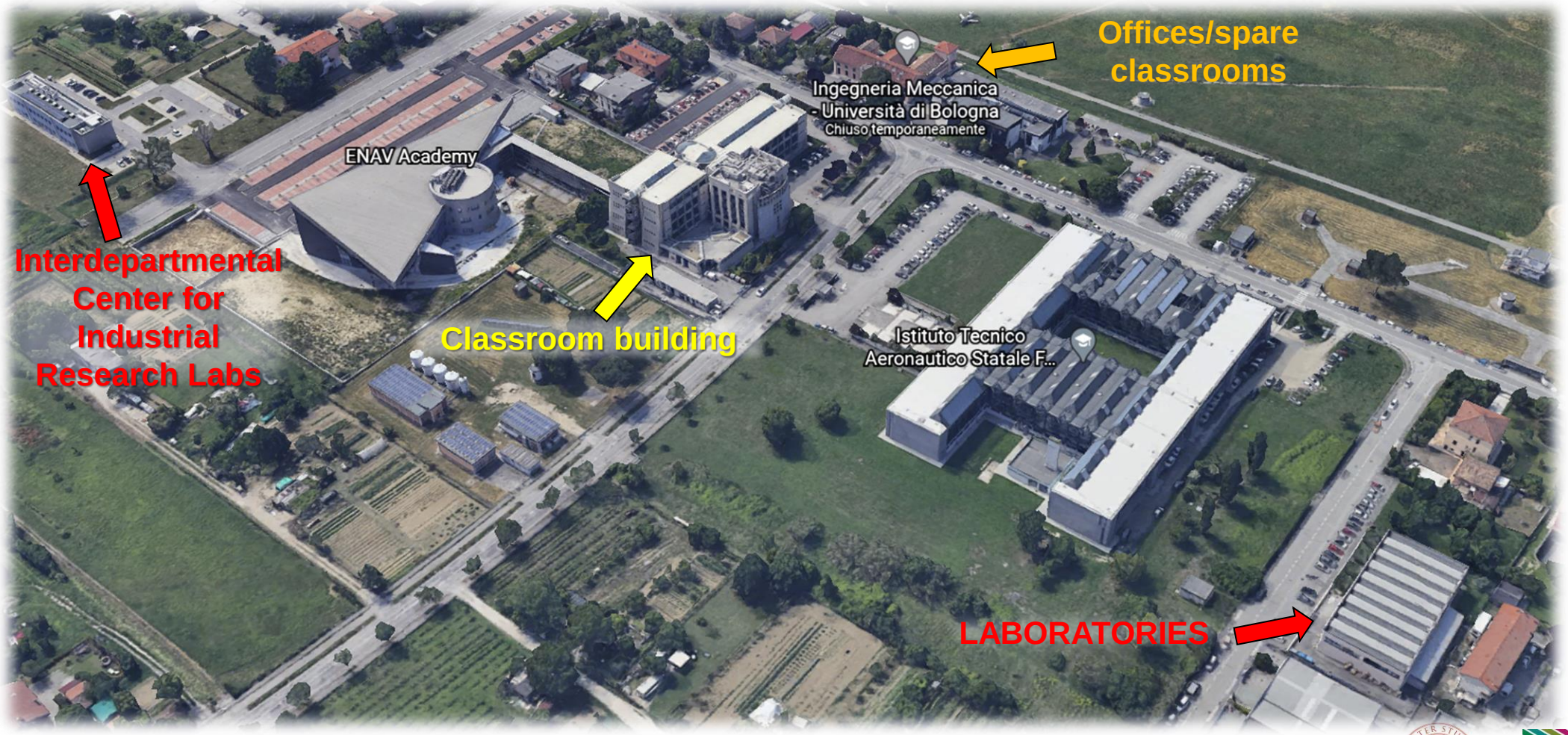
Interdisciplinary Laboratories (12 ECTS)

Second Semester

- Sustainable Mobility Laboratory (6 ECTS)
  - Powertrain Testing (3 ECTS)
  - Thermal Control (3 ECTS)
- Predictive Maintenance and Condition Monitoring Laboratory (6 ECTS)
  - Vibration Analysis (3 ECTS)
  - Predictive Maintenance (3 ECTS)
- Design and Virtual Prototyping of Automatic Machines (6 ECTS)
  - Design of Automatic Machines (3 ECTS)
  - Virtual Prototyping (3 ECTS)
- Sustainable Industry Laboratory (6 ECTS)
  - Industrial Automation (3 ECTS)
  - Sustainable Industrial Logistics (3 ECTS)
- Digital Engineering Laboratory (6 ECTS)
  - Virtualization of Mechatronic Systems (3 ECTS)
  - Extended Reality for Digital Twin of Mechatronic Systems (3 ECTS)

Mechanical Engineering for Sustainability

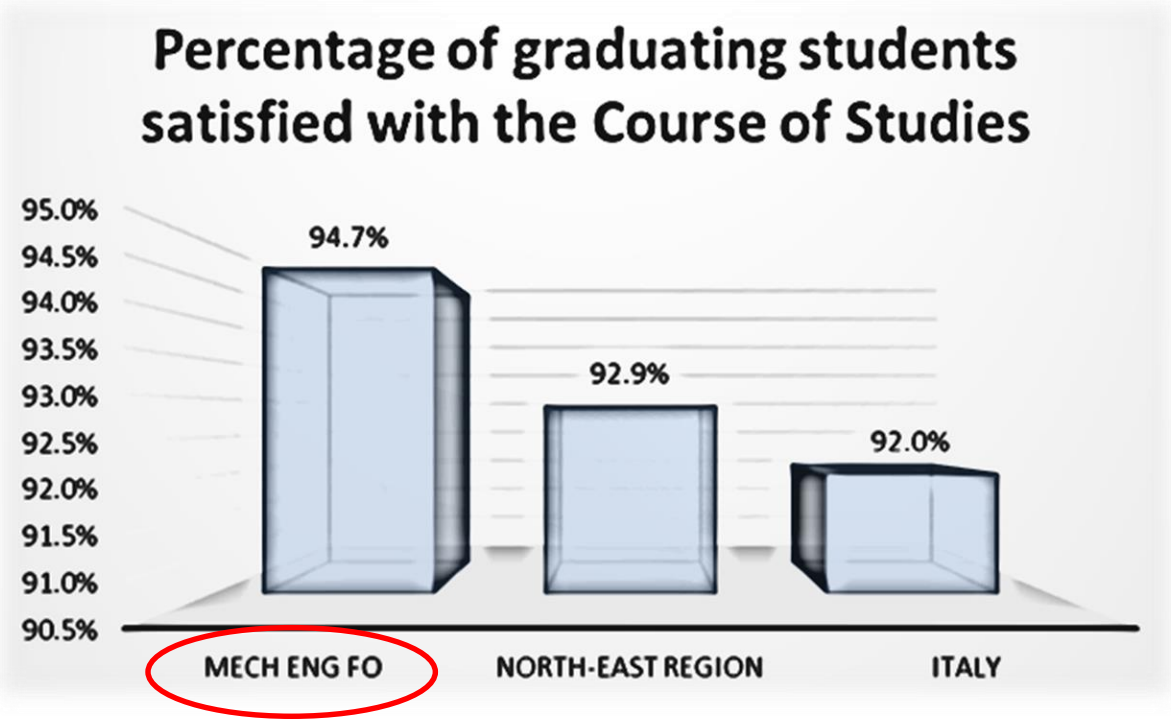
Where we are

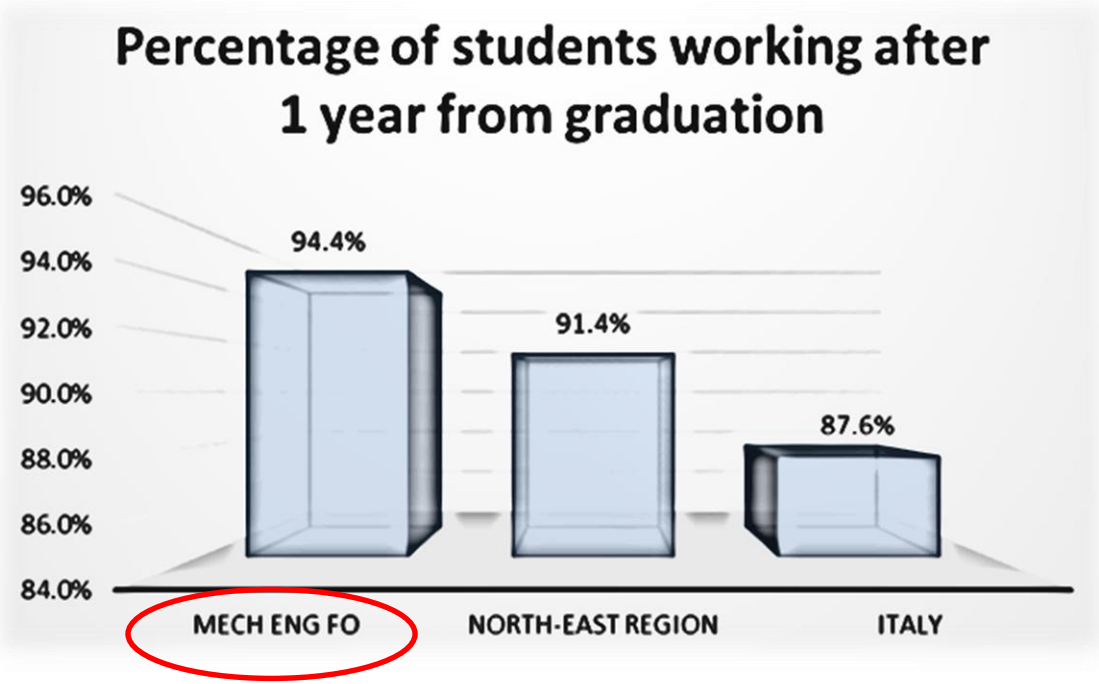


Mechanical Engineering for Sustainability

Our Numbers

Even though MES is a totally new initiative, our team has a strong track record of students' satisfaction and employability





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Useful links

- where can i get updated information on the course of study?

  https://corsi.unibo.it/2cycle/MechanicalEngineering-Forli

- contacts?
  - Francesco Semprucci (course tutor): francesco.semprucci2@unibo.it
  - Giulio Traversa (tutor for international mobility): didatticaforli.internazionalizzazione.ing@unibo.it
  - Giulia Chiadini (programme coordinator): didatticaforli.ingstudenti@unibo.it
  - Enrico Corti (course director): enrico.corti2@unibo.it
- specific information on the admission to Mechanical Engineering for Sustainability: Programme enrolment: requirements, deadlines and methods — Mechanical Engineering for Sustainability - Laurea Magistrale - Forlì (unibo.it)

Useful links

- General information on the enrollment procedure for international students

  https://www.unibo.it/en/teaching/enrolment-transfer-and-final-examination/enrol-for-first-single-cycle-or-second-degree-programme

- General info for international students: International — University of Bologna (unibo.it)
- Grants for International Students: Study grants and exemptions for international students — University of Bologna (unibo.it)
- Information on Forlì Campus: Forlì Campus — University of Bologna (unibo.it)

Collegio Superiore: an institution of excellence

An **interdisciplinary** and **multi-sectoral** educational programme

What it is

An **interdisciplinary** and **multi-sectoral** educational programme

Who it is for

Talented and committed students enrolling in a Master's degree programme

What you get

Upon completion of the Ordinary Humanistic-Social or Scientific-Technological Course (24 credits), you are awarded the Diploma of the Collegio Superiore.

What it provides

- a high-profile **Tutor**
- **mobility** with other institutions of excellence
- **free accommodation** at the Irnerio Residence of the Collegio Superiore
- other economic benefits

To find out more go to **"Admission & Opportunities Stands"**

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