Master Neuroengineering and Rehabilitation

2024-2025

Master in Neuroengineering and Rehabilitation

1. UPC/ETSEIB introduction
2. Master Neuroengineering and Rehabilitation
3. Q & A
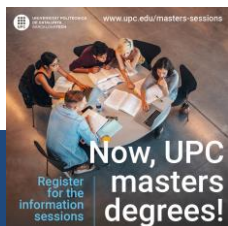
molt +
a l'ETSEIB
MÀSTERS

ETSEIB

UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH
UPC

29.812 estudiants	**3.523** PDI	**2.074** PAS	**65** graus	**84** màsters	**45** programes de doctorat
18 centres docents	**275** programes de formació permanent	**19** patents el darrer any	**348 M** pressupost 2023	**72,7 M** ingressos per R+D+I (2021)	**70.151** Alumni

ETSEIB

16	Departments
2	Institutes
2	Bachelor degrees (GETI, GETIAE)
15	Master's programs
3379	Students
446	Teaching and Research Staff (PDI)
126	Administrative and Support Staff (PAS)

Now, UPC masters degrees!
www.upc.edu/masters-sessions
Register for the information sessions

UNIVERSITAT POLITÈCNICA
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UPC

ETSEIB School
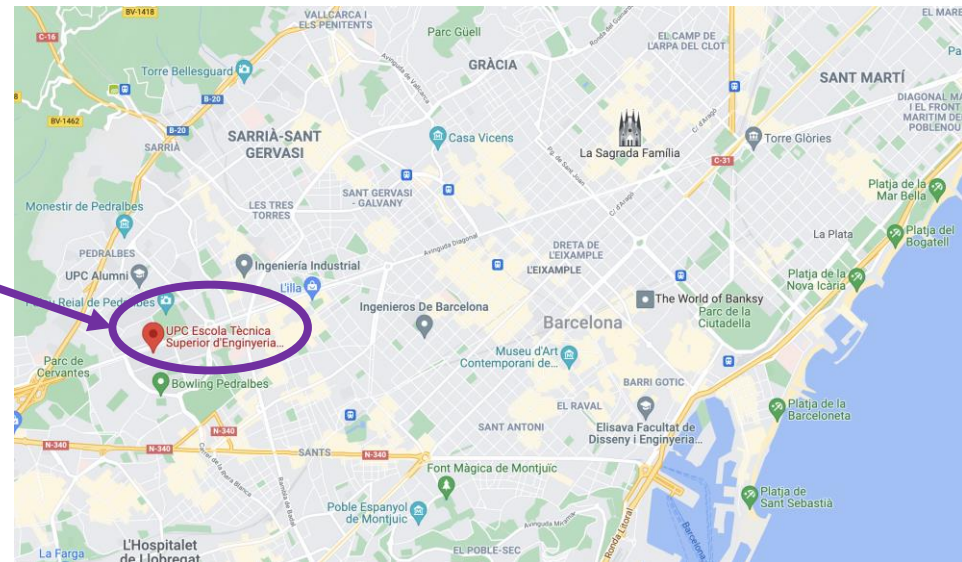
ETSEIB: Escola Tècnica Superior d'Enginyeria Industrial de Barcelona

Over 170 years of educating professionals with a very strong scientific and technical foundation
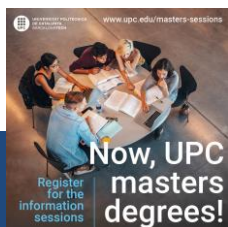
https://etseib.upc.edu/

ETSEIB Master's degree programmes

1. **Master's degree in Neuroengineering and Rehabilitation (with UAB)**
2. **Master's degree in Biomedical Engineering (with UB)**
3. **Master's degree in Automatic Control and Robotics**
4. **Master's degree in Automotive Engineering**
5. **Master's degree in Management Engineering**
6. **Master in Nuclear Engineering / EMINE**
7. **Master in Electric Power Systems and Drives**
8. **Master in Thermal Engineering / DENSYS**
9. **Master in Energy Engineering / MSc Programmes in Energy InnoEnergy**

How to apply

(https://etseib.upc.edu/en/Academic%20programmes/academic-procedures/acces/application-msc-programmes)

- **Application**
  Deadline: 13th of May 2024
- **Acceptance (Academic Comission)**
  June 2024
- **Provisional listing of accepted students**
  Before the end of June 2024
- **Students' acceptance**
  Up to 7 days from the publication of the listing
- **Definitive listing of accepted students**
  Mid-July 2024
- **Enrolment**
  Check information at website etseib.upc.edu

How to apply

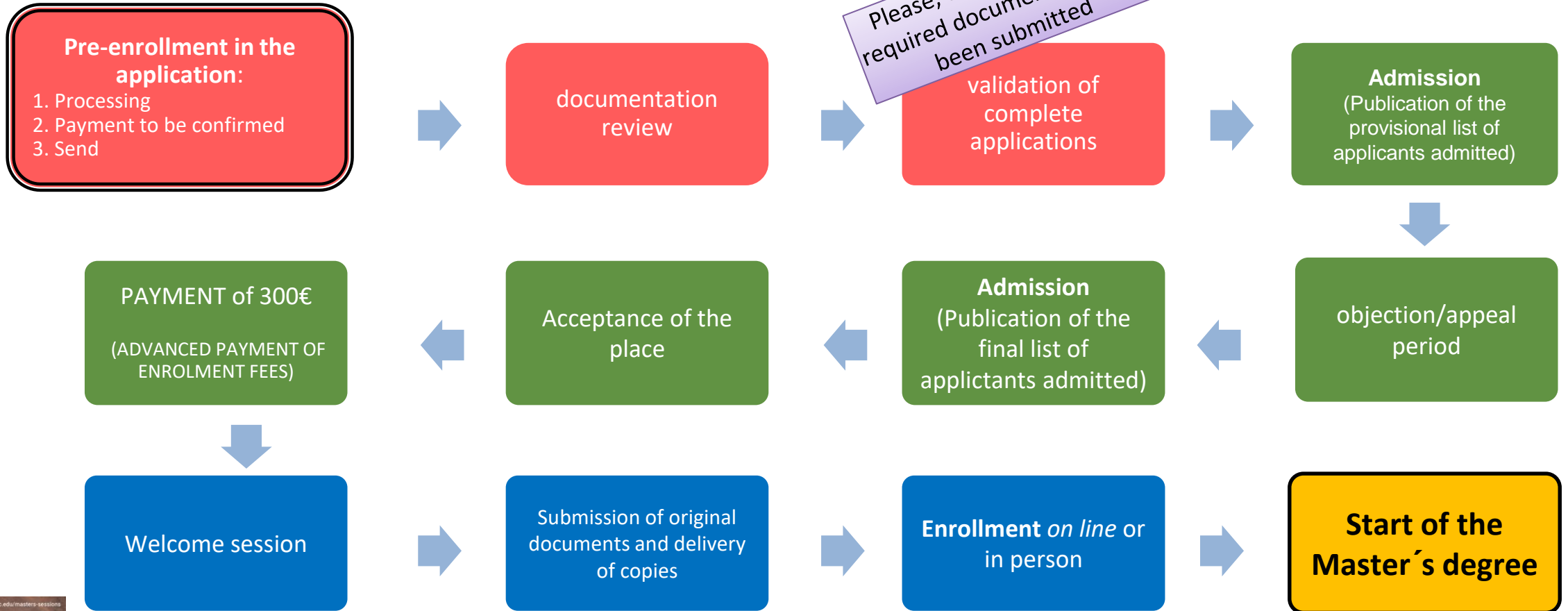How to apply:

Apply **UPC Admissions:** [**Application** ⧉]

To validate the request, it is necessary to complete the information for every field:

- *Personal data*
- *Academic details*
- *Required documentation* [**Required documents** ⧉]
- *Application* (*) (choose 3 specialty options for the master required)
- *Data protection*
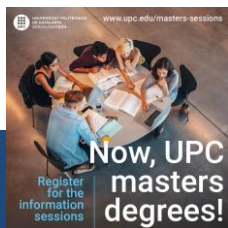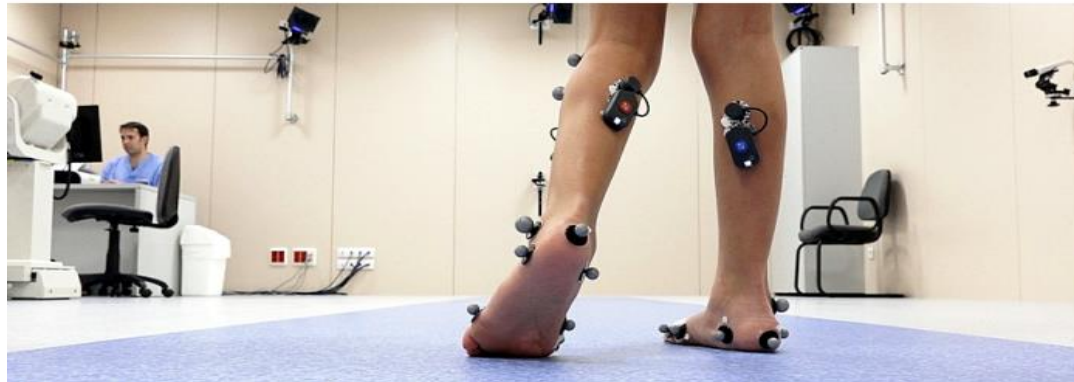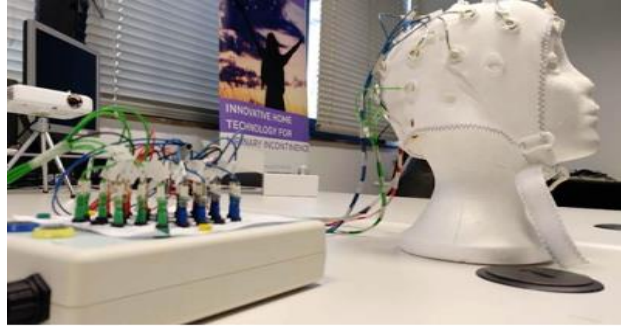- *Pre-enrolment fees* (General information about UPC" on this **page** ⧉)

Now, UPC masters degrees!

Admission and enrollment process

Pre-enrollment in the application:
1. Processing
2. Payment to be confirmed
3. Send

documentation review

Please, check that all the required documentation has been submitted

validation of complete applications

Admission
(Publication of the provisional list of applicants admitted)

PAYMENT of 300€

(ADVANCED PAYMENT OF ENROLMENT FEES)

Acceptance of the place

Admission
(Publication of the final list of applicants admitted)

objection/appeal period

Welcome session

Submission of original documents and delivery of copies

Enrollment *on line* or in person

Start of the Master´s degree

Master in Neuroengineering and Rehabilitation

- **Neuroengineering** is a discipline to understand, repair or enhance neural systems: restoration and augmentation of human function via human-machine computer interfaces between nervous system and artificial devices.
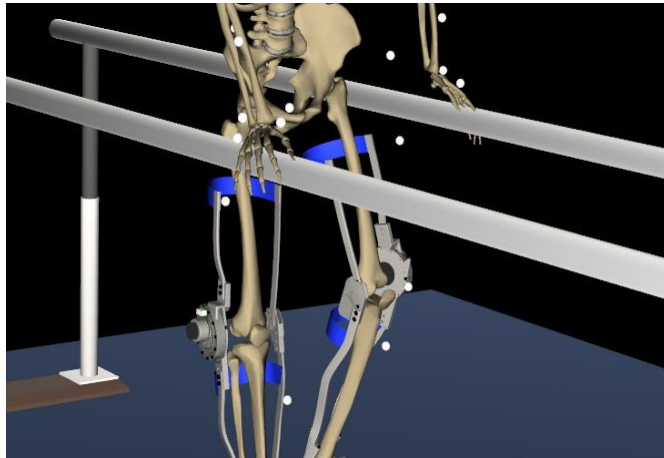
- **Rehabilitation** is a highly specialized clinical & technical process aimed at restoring and/or compensating for the functional alterations of the person affected by a disability.

- The **master's degree in Neuroengineering and Rehabilitation (MNER)** offers an excellent opportunity to bachelor's graduates with basic background on engineering to continue their specialization or to focus their career in this social need with high health and economic impact.
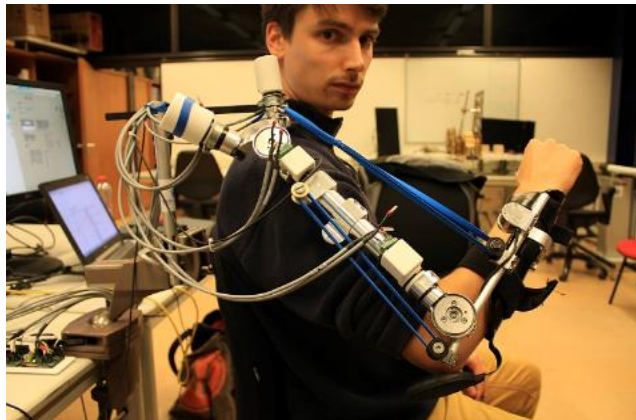
- The courses of this master's program provide knowledge and skills related to **neural engineering; sensory, brain and muscle systems; biomechanics; assistive technology; and cognitive, motor and cardiorespiratory therapies**, among others

MNER: Topic

- This is an interuniversity master's degree: it emerged from the long collaboration on research, innovation projects and teaching between

Research Centre for Biomedical Engineering (CREB) from the Universitat Politècnica de Catalunya (UPC)

Institut Guttmann Neurorehabilitation Hospital, an affiliated centre of Universitat Autònoma de Barcelona (UAB).

Neurosciences Institute, from the UAB

Neurorehabilitation Hospital Guttmann Institute

2. Neuropsychological rehabilitation

1. Physical rehabilitation

3. Disability management (prevention, comorbidity, care)

4. Brain Health and Aging

5. Social

(YEAR 2022)

79 Research Projects and Studies

8 Clinical Trials

>100 Researchers

60 Journal Articles

Neurorehabilitation Hospital Guttmann Institute

- 90 ECTS

  (shared with UAB – Guttmann Institute Neurorehabilitation Hospital- Neurosciences Institute)

- 30 places

- **Main backgrounds:** Industrial Engineering, Physics Engineering, Industrial Electronics and Automatica Engineering, Biomedical Engineering.

- **Secondary background:** Electronic Systems, Telecommunications Systems and Electronics, Computer Science, Electrical/Electronic/Mechanical Engineering, Physics, among others (possible Complementary Training).

- **Objective:**

  Train professionals in a multidisciplinary manner with a high level of competencies, which allows them to adapt and facilitate responsibility work groups in hospitals, companies or research centers in the field of neuroengineering and rehabilitation, and the technology that is associated..
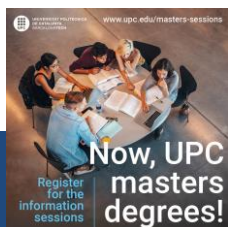
MNER: Curriculum

1st semester

Anatomy and Physiopathology	4.5
Rehabilitation Therapies	3
Mobility Assistive Technologies	4.5
Biomedical Signals	4.5
Medical Image	4.5
Biomaterials	4.5
Modelling and Simulation of Biomedical Systems	4.5

2nd semester

Rehabilitation Equipment	3
Human-Machine Interfaces	4.5
Neuromodulation and Neurostimulation	3
Data Analysis in Rehabilitation	4.5
Neuroimage	4.5
m-Health Systems	3
Virtual Reality and Serious Games	3
Biomechanics	4.5

3rd semester

Work Placement	18
Master's Thesis	12

| First Semester (September-January)	Second Semester (February-June)
Anatomy and Physiopathology (4.5 credits) Skeletal muscle. Motor nervous system. Somatosensory and Autonomic nervous system. Cardiorespiratory system	**Biomechanics** (4.5 credits) Kinematics and Dynamics of human movement. Analysis of human gait. Energetics applied to human movement
Rehabilitation Therapies (3 credits) Neurorehabilitation of spinal cord injury, acquired brain lesions & neurodegenerative diseases. Cardiorespiratory rehabilitation	**Virtual Reality and Serious Games** (3 credits) Fundamentals of 3D graphics. Virtual and augmented reality. Gamification. Collection of results. Examples of serious games
Mobility assistive technologies (4.5 credits) Prosthetic systems. Orthotic systems and exoskeletons. FES systems. Sensors & control strategies. Robot-FES hybrid control	**m-Health Systems** (3 credits) m-Health systems architecture design. Mobile platforms. Development Tools. Data communication networks. Regulation
Biomedical Signals (4.5 credits) Matched and adaptive filtering. Spectral estimation: nonparametric and parametric methods. TFR	**Data Analysis in Rehabilitation** (4.5 credits) Feature extraction and selection techniques. Connectivity & Graph analysis. Statistics. PCA & ICA. Machine Learning.
Medical Images (4.5 credits) Creation, reading and visualization of an image. Image filtering, 2D and 3D segmentation. Volume display. Design of GUI	**Neuroimage** (4.5 credits) Structural (MRI, DTI, TAC) & Functional (fMRI, PET, hdEEG, MEG) imaging. Structural connectivity. Inverse brain modeling
Biomaterials (4.5 credits) Applications in implants & rehabilitation. Traumatology. Tissue engineering. Physical medicine and rehabilitation.	**Human-Machine Interfaces** (4.5 credits) Endogenous vs. exogenous BCI systems (evoked potentials) Movement intention. Motor imagery EMG-based HMI systems
Modeling and Simulation of Biomedical Systems (4.5 credits) Mathematical modeling. Identification of rehabilitation control Systems. Optimization of systems. Nonlinear system analysis.	**Neuromodulation and Neurostimulation** (3 credits) Neural Plasticity. Brain and Spinal stimulation and neuromodulation techniques (invasive and non-invasive)
Third Semester (September-January)	**Rehabilitation Equipment** (3 credits) Medical instrumentation. Cognitive/cardiorespiratory rehabilitation equipment. Normative and regulation. Bioethics
Work placement (18 credits) **Master's Degree Dissertation** (12 credits)	

Why choose this Master's Degree?

- This provides **rigorous training in the field of Neuroengineering and Rehabilitation** and responds to the high demand for specialists in this field.

- In spite of existing these studies abroad, mainly in the US and UK, **this official master's degree is the only one in Spain**

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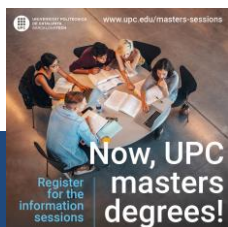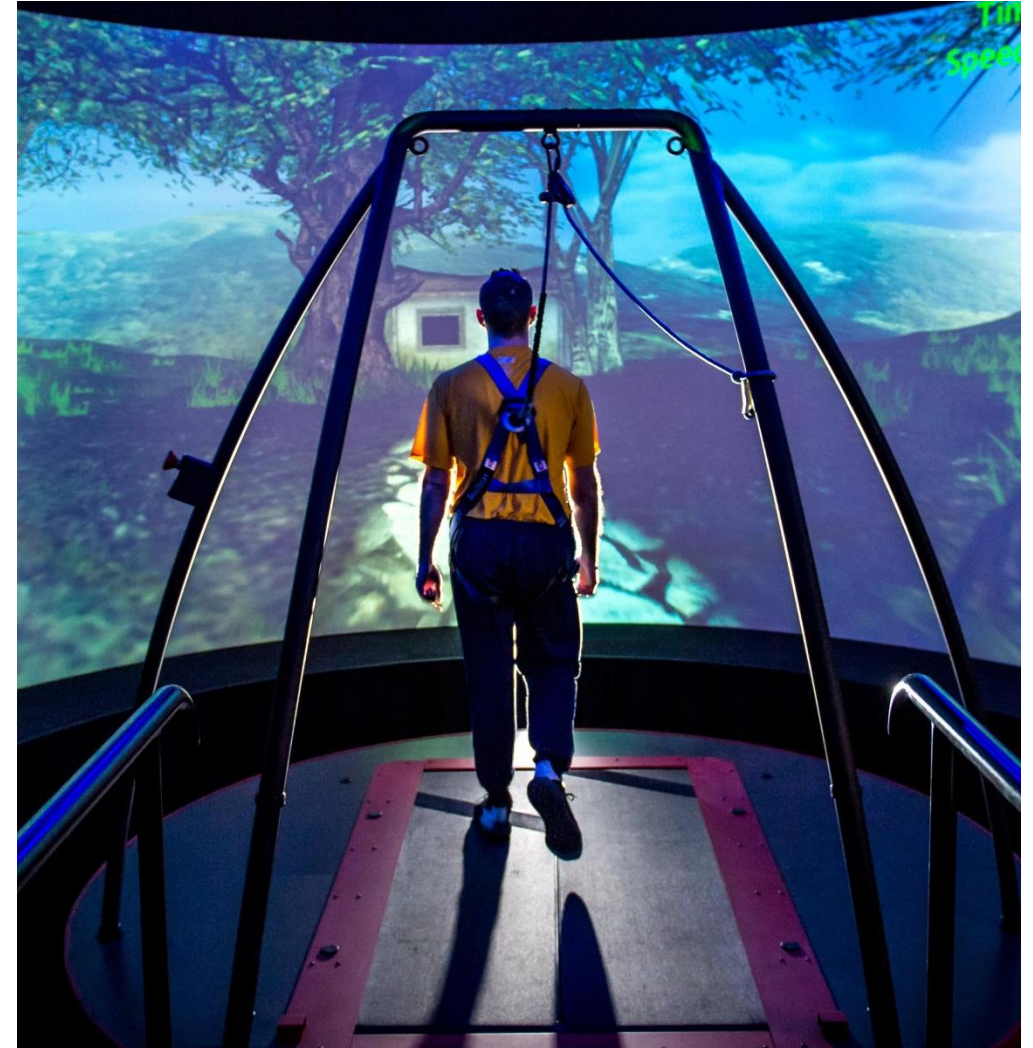
Why choose this Màster's Degree?

- Researchers and professors at CREB and IG are leaders in their respective sectors, which ensure that this master's degree provides students with **multidisciplinary training and is adapted to new technologies** in the sector.

- This also trains **qualified professionals**, currently still few in the field and with a very high occupancy rate, and enables them to easily adapt to positions of responsibility in **hospitals, companies or research centres**.

- Graduates can also work as **freelancers and entrepreneurs**. There is particularly a high demand in Catalonia, the University's area of influence, which is one of the most dynamic hubs in medical technologies

# Barcelona School of Industrial Engineering (ETSEIB)

- The headquarters of the CREB are at **the ETSEIB, where most of the lectures will be taught** by experts from many departments who work in exoskeletons, e-walkers, virtual reality, serious games, brain/human-machine interfaces, instrumentation equipment, assistive robotics, m-Health, etc.

- Thus, there are contents of computer graphics, electronics, biomedical signals, deep learning, robotics, vision, electronics, mechanics, etc., oriented towards NER rather than BME in general.
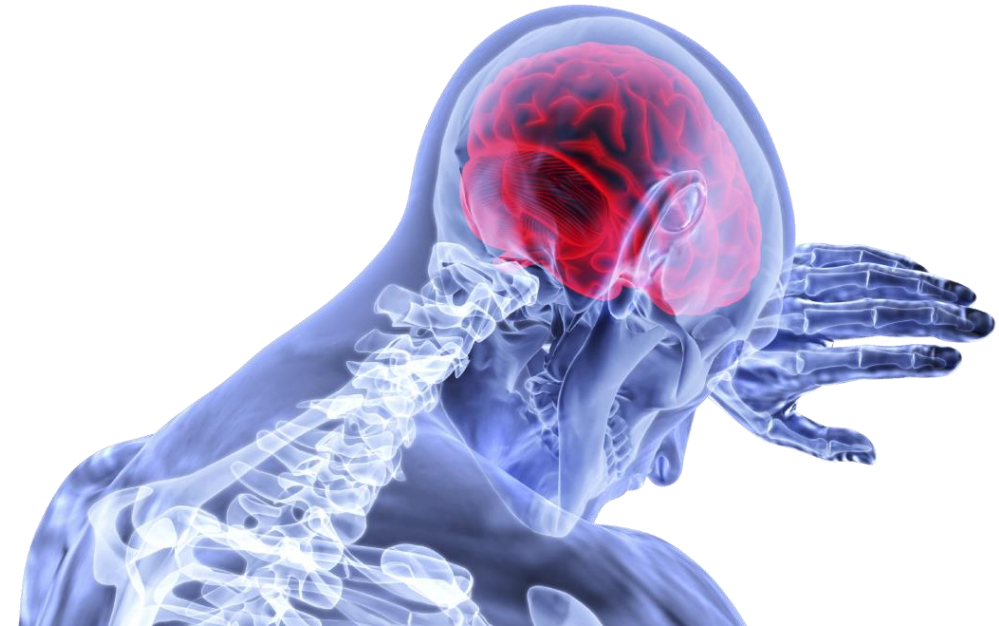
- This master's degree provides the opportunity **to collaborate during the last semester with a company or a hospital in a real environment, with a research group, or other national and international research institutions** completing the Master's Degree Dissertation.

- The ETSEIB allows students to spend a semester abroad, generally through Erasmus program for Europe.

- After completing the master's degree, you can directly access the Biomedical Engineering doctorate program at the UPC (3 years of doctoral thesis, without complementary training). Industrial doctorate is also possible by companies in the sector
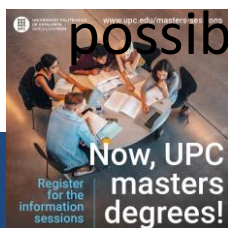
... further information

FAQ's

Check the most frequently asked questions in this document ⧉.

International Relations and Admissions Office

Face-to-face opening office hours:

from Monday to Friday 11 am to 1:30 pm

and Tuesday 3.00 pm to 17.30 pm

Information request: https://demana.upc.edu/etseib/

📞+34 93 401 59 27

Thank you for your attention

admissions.etseib@upc.edu