Master's degree in Neuroengineering and Rehabilitation

The **master's degree in Neuroengineering and Rehabilitation** aims to produce highly qualified engineers by providing students with multidisciplinary training and developing a high level of competence that enables them to easily adapt to positions of responsibility with hospitals, companies or research centres in the field of neuroengineering and rehabilitation. Students will acquire knowledge of the theoretical and practical foundations of neuroengineering and rehabilitation and the technology associated with this field. The subjects taught provide knowledge and skills related to neural engineering; sensory, brain and muscle systems; assistive technology; and cognitive, motor and cardiorespiratory therapies, among others.

GENERAL DETAILS

Duration and start date

1.5 academic years, 90 ECTS credits. Starting September

Timetable and delivery

Face-to-face

Fees and grants

Approximate fees for the master's degree, excluding other costs, €2,490 (€3,735 for non-EU residents).
More information about fees and payment options
More information about grants and loans

Language of instruction

Subjects will be taught in Catalan, Spanish or English, depending on the student's level of comprehension and on the teaching objectives of the master's degree.

Location

Barcelona School of Industrial Engineering (ETSEIB)
University Institute of Neurorehabilitation (UAB)

Official degree

Official title

ADMISSION

General requirements

Academic requirements for admission to master's degrees

Specific requirements

To be admitted to the master's degree, applicants must have at least a B2.2 level of English as defined in the Common European Framework of Reference for Languages. However, applicants will not be required to pass any specific test of their linguistic competence in English to gain admission.

Direct admission

The master's degree is designed for students who have completed a bachelor's degree in engineering and acquired at least a basic multidisciplinary knowledge of fields such as instrumentation, electronics, mechanics, informatics and discrete-time control. The bachelor's degrees that provide training in all of these fields and that therefore best prepare students for this master's degree and qualify them for direct admission are those listed below. Graduates of these degrees are not required to take any bridging courses.

- Bachelor's degree in Industrial Technology Engineering.
- Bachelor's degree in Engineering Physics.
- Bachelor's degree in Industrial Electronics and Automatic Control Engineering.
- Bachelor's degree in Biomedical Engineering.

The master's degree will focus on further developing and applying this technical knowledge in the health field,

specifically in neuroengineering and rehabilitation.

Bridging courses

For holders of degrees other than those that provide direct admission, the academic committee may consider an applicant's previous training on a case-by-case basis and determine what bridging courses must be taken to attain the required level of knowledge and skills in accordance with the entrance qualification.

These degrees are the following:

- Bachelor's degree in Electronic Engineering and Telecommunications.
- Bachelor's degree in Electronic Systems Engineering.
- Bachelor's degree in Telecommunications Systems Engineering.
- Bachelor's degree in Informatics Engineering.
- Bachelor's degree in Materials Engineering.
- Bachelor's degree in Mechanical Engineering.
- Bachelor's degree in Electrical Engineering.
- Bachelor's degree in Physics.
- Other engineering degrees or equivalent pre-EHEA degrees.

For students who have completed one of these degrees, the academic committee for the master's degree will determine what bridging courses must be taken on a case-by-case basis according to the applicant's degree and previous training.

The bridging courses required will depend on the undergraduate degree and optional subjects a student has taken, which, given the defined admission profile, must be related to the following subjects and credit ranges, as stipulated by the academic committee:

- Mechanical and Materials Engineering (from 0 to 10.5 credits).
- Electrical, Electronic and Automatic Control Engineering (from 0 to 12 credits).
- Industrial Electronics (from 0 to 6 credits); Signals and Systems (from 0 to 4.5 credits).
- Other subjects stipulated by the committee in accordance with the entrance profile.

Students who would need to complete bridging courses carrying a total of over 30 ECTS credits will not be admitted to the master's degree.

Bridging courses must be taken in the first semester of the programme and must be subjects currently taught in bachelor's degrees offered by the Barcelona School of Industrial Engineering (ETSEIB) or equivalent subjects authorised by the academic committee for the master's degree.

Admission criteria

- Academic record: 60%
- Professional experience: 10%
- English-language level: 10% (proof of a level corresponding to a B2.2 certificate in the Common European Framework of Reference)
- Entrance qualification: 20%

Places

40

Pre-enrolment

Pre-enrolment closed (consult the new pre-enrolment periods in the academic calendar).
How to pre-enrol

Enrolment

How to enrol

Legalisation of foreign documents

All documents issued in non-EU countries must be legalised and bear the corresponding apostille.

PROFESSIONAL OPPORTUNITIES

Professional opportunities

This master's degree prepares graduates for careers in neuroengineering and rehabilitation, including positions with start-ups and large companies that develop medical technologies, and posts at centres for research, development and

innovation. Students develop a high level of technological expertise that qualifies them to perform a wide range of roles in various departments, including product engineering and development; clinical design and validation; technology management and innovation; RDI; development and innovation in products, processes and methods; new technologies and management systems; project management in this field; and strategic consulting.

Work areas:

- Hospitals and clinical/health centres at different levels, including neurorehabilitation and motor or cardiac rehabilitation services and intensive or semi-critical care units.
- Companies in the medical technology sector that develop equipment.
- Technology and research centres related to neuroengineering and rehabilitation, in research, innovation and development activities.
- Innovative and technology-based start-ups involved in developing assistive technologies for neurorehabilitation.

Competencies

Generic competencies

Generic competencies are the skills that graduates acquire regardless of the specific course or field of study. The generic competencies established by the UPC are capacity for innovation and entrepreneurship, sustainability and social commitment, knowledge of a foreign language (preferably English), teamwork and proper use of information resources.

Specific competences

- To describe the main pathophysiological processes of neurological and cardiorespiratory diseases that cause disabilities.
- To understand processes of regeneration and plasticity in the nervous system.
- To demonstrate mastery of patient treatment and care techniques aimed at improving the quality of life of people affected by disabilities of neurological or cardiorespiratory origin.
- To identify advanced examination methods and techniques for diagnosis and therapy in rehabilitation.
- To follow the principles that apply to the use of equipment and systems for motor and cognitive neurorehabilitation and cardiorespiratory monitoring and therapy.
- To manage bibliography, documentation, databases and software used in rehabilitation engineering, as well as regulations on medical devices.
- To analyse and design prosthetic/orthotic systems for mobility assistance in upper and lower extremities.
- To analyse and design control strategies for movement assistance or rehabilitation.
- To acquire, segment, process and interpret bioelectric signals of muscular and cerebral origin.
- To design and develop human-machine communication systems.
- To follow the principles that apply to the use of equipment and develop diagnostic and therapeutic strategies for neurostimulation, neuromodulation and neuroprosthesis.
- To apply analytic techniques and interpret biomedical signals and images.
- To appropriately apply the main data processing and statistical methods.
- To apply self-learning systems based on supervised and unsupervised classification algorithms and understand their practical implications in the design of rehabilitation systems.
- To apply computer vision, shape recognition and multisensory data fusion techniques.
- To apply advanced neuroimaging techniques and be familiar with tools for applying them.
- To design and develop biomaterials for medical applications (for therapeutic or diagnostic purposes) that can be used to replace and/or regenerate living tissues either alone or integrated into complex devices.
- To develop biomechanical models of the musculoskeletal system based on anthropometry of the human body and the mechanical laws of motion.
- To analyse kinematic, dynamic and energetic aspects of human movement using musculoskeletal models and software for analysing and simulating movement.
- To mathematically model and implement physiological models for the simulation and prediction of processes underlying rehabilitation and pathologies in general.
- To experimentally test the validity of theoretical models of equipment, devices, machines and systems used in rehabilitation engineering.
- To design, develop and evaluate m-health systems within the regulatory framework for the market (EU, USA).
- To identify the characteristics of an augmented reality system or serious game for rehabilitation.
- To identify the principles of gamification and design experiments to validate the effects of this approach in a rehabilitation system.
- To identify, formulate and solve complex problems in neuroengineering and rehabilitation.

- To present and defend before an examination committee an original, individual piece of work consisting of a comprehensive neuroengineering and rehabilitation project that synthesises and integrates the competencies acquired on the master's degree.

ORGANISATION: ACADEMIC CALENDAR AND REGULATIONS

UPC school

Barcelona School of Industrial Engineering (ETSEIB)

Participating institutions

Universitat Politècnica de Catalunya (UPC) - **coordinating** university
University Institute of Neurorehabilitation Guttmann (UAB)

Academic coordinator

Miquel Àngel Mañanas Villanueva
Josep Ma. Font Llagunes

Academic calendar

General academic calendar for bachelor's, master's and doctoral degrees courses

Academic regulations

Academic regulations for master's degree courses at the UPC

CURRICULUM

Subjects	ECTS credits	Type
FIRST SEMESTER		
Anatomy And Physiopathology	4.5	Compulsory
Biomaterials	4.5	Compulsory
Biomedical Signals	4.5	Compulsory
Medical Images	4.5	Compulsory
Mobility Assistive Technologies	4.5	Compulsory
Modelling and Simulation of Biomedical Systems	4.5	Compulsory
Rehabilitation Equipment	4.5	Compulsory
Rehabilitation Therapies	3	Compulsory
SECOND SEMESTER		
Biomechanics	4.5	Compulsory
Data Analysis in Rehabilitation	4.5	Compulsory
Human-Machine Interfaces	4.5	Compulsory
M-Health Systems	3	Compulsory
Mobility Assistive Technologies	3	Compulsory
Neuroimage	4.5	Compulsory
Neuromodulation And Neurostimulation	3	Compulsory
Rehabilitation Equipment	3	Compulsory
Virtual Reality and Serious Games	3	Compulsory
THIRD SEMESTER		

Subjects	ECTS credits	Type
Work Placement	18	Compulsory
Master's Thesis	12	Project