Master's degree in Photonics

The goal of the **master's degree in Photonics** (**master's degree website**) is to provide students with a solid grounding in the various areas of photonics and with the tools they need to become researchers or entrepreneurs in this field. The most important institutions carrying out research in photonics in the Barcelona area, namely, the UAB, the UB, the UPC and the ICFO, participate in this master's degree and offer comprehensive training that covers theoretical and applied topics.

GENERAL DETAILS

Duration and start date

One academic year, 60 ECTS credits. Starting September

Timetable and delivery

Afternoons. Face-to-face

Fees and grants

Approximate fees for the master's degree, **excluding other costs** (does not include non-teaching academic fees and issuing of the degree certificate):
€1,660 (€6,331 for non-EU residents).

- **Telecogresca**: 1 scholarship for the 1st.

More information about fees and payment options
More information about grants and loans

Language of instruction

English

Information on language use in the classroom and students' language rights.

Location

From September to December, all courses are taught on the UB (Barcelona) and UAB (Bellaterra) campuses. From December to April, all courses are taught on the UPC's North Campus (Barcelona).
Laboratory practicals, seminars, visits and master's theses, however, may be carried out at any of the four participating institutions.

Official degree

Recorded in the Ministry of Education's degree register

ADMISSION

General requirements

Academic requirements for admission to master's degrees

Specific requirements

Students must be in possession of an official University degree in a scientific or technological field corresponding to at least 180 ECTS credits (validated for European students or students from partner countries), in the fields of physics, engineering physics, telecommunications engineering, electrical, mechanical and electronic engineering and optics, or in a related field such as nanoscience and nanotechnology, nanophotonics and bioengineering.

Other qualifications (in chemistry, materials science, biology, etc.) may be considered by the admissions committee, which will recommend specific bridging courses.

Admission criteria

Admission to the master's degree in Photonics is evaluated in view of applicants' academic records (their academic performance as well as the appropriateness of their qualification).
The following aspects will also be considered:

- A letter of recommendation from a person with a scientific or academic background in the field of optics/photonics or a related discipline who has interacted with the student.

- Professional experience in the field of optics/photonics or a related discipline.
- Proof of scientific activity in the field of optics/photonics, such as collaboration with established research groups, scientific publications and presentations at conferences.
- A personal interview with the admissions committee (if necessary).

Places

35

Pre-enrolment

Pre-enrolment period open.
Expected deadline: 01/07/2024.

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

The particular fields that students may be employed in once they graduate are proliferating, given the interdisciplinary nature and increasing relevance of photonics, which has been selected as one of five Key Enabling Technologies for the future of the European Union. The master's degree in Photonics complements bachelor's degrees in the sciences (particularly physics) and engineering (particularly engineering physics, telecommunications engineering, electrical, mechanical and electronic engineering and optics, as well as related fields such as nanophotonics and bioengineering) and provides broader and more specific training on scientific advances and interdisciplinary technologies. Career prospects may include the following:

• Taking a doctoral degree in Photonics, Optics, Physics, Optical Engineering, Nanophotonics, Biophotonics, Telecommunications, Electronics, Imaging, Quantum Information, etc.
• Participating in doctoral programmes, R&D and innovation programmes in companies, basic or applied research centres and universities.
• Joining a large company as a consultant or engineer on photonics-related topics, applications development engineer, sales specialist or laboratory consultant.
• Working as a freelance advisor or consultant on photonics-related subjects.
• Working in highly specialised technical positions for controlling services such as microscopy, X-ray diffraction, thin films, etc.
• Participating in (and promoting) spin-offs and other small technology-based companies.
• Joining the education system for high-level training in the field of photonics.

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 competencies

- An understanding of the physical principles of optics and light-matter interaction, at classical and quantum levels.
- The ability to perform basic experiments in photonics and to analyse and understand advanced experiments and calculations in the fields chosen by the student.
- An understanding of laser physics and knowledge of the variety of laser types and main related applications.

- Knowledge of the fundamentals of image formation, light propagation through different media and Fourier optics.
- An understanding of the main concepts, underlying phenomena and most recent applications in the optional subjects chosen by students (quantum optics, biophotonics and imaging, nanophotonics, telecommunications, optical engineering, etc.).
- The ability to deal with an advanced research problem in photonics from start to finish, i.e., from conceptual planning and bibliographic research to the oral and written communication of the results, according to the procedures and conventions of scientific presentations in English.
- The ability to understand optical engineering as an economic and business activity and to take into account social, ethical and sustainability aspects.
- An awareness of the importance of patents and the ability to understand and write a patent in the field of photonics.

ORGANISATION: ACADEMIC CALENDAR AND REGULATIONS

UPC school

Barcelona School of Telecommunications Engineering (ETSETB)

Participating institutions

Universitat Politècnica de Catalunya (UPC) - **coordinating** university
Institute of Photonic Sciences (ICFO)
Universitat Autònoma de Barcelona (UAB)
Universitat de Barcelona (UB)

Academic coordinator

Crina Cojocaru

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 COURSE		
3D Light Control for Biological Applications	3	Optional
Active and Spectral Imaging	3	Optional
Advanced Quantum Optics with Applications	3	Optional
Beam Propagation and Fourier Optics	5	Compulsory
Business and Patents in Photonics	5	Compulsory
Experimental Optical Techniques in Biology	3	Optional
Fibers and Telecommunications	3	Optional
From Cooling and Trapping of Neutral Atoms to Bose-Einstein Condensates	3	Optional
Image Processing in Biophotonics	3	Optional
Integrated Photonics	3	Optional
Introduction to Photonics. Optics and Lasers	5	Compulsory
Laser Systems and Applications	3	Optional
Machine Learning on Classical and Quantum Data	3	Optional

Subjects	ECTS credits	Type
Managing Light with Devices	3	Optional
Measuring with Light	3	Optional
Nanophotonics	3	Optional
Non-Linear Optics	3	Optional
Optical Design	3	Optional
Optics and Photonics Lab I	5	Optional
Optics and Photonics Lab II	5	Optional
Optoelectronics and Photovoltaic Technology	3	Optional
Photonics Laboratory	5	Compulsory
Photonics Materials and Metamaterials	3	Optional
Quantum Light-Matter Interfaces: Modern Systems and Applications	3	Optional
Quantum Optics	3	Optional
Quantum Simulators with Ultracold Quantum Gases	3	Optional
Qubit Applications	3	Optional
Research Seminar	30	Optional
Semiconductor Photonics: Applications and Technology	3	Optional
Ultrafast and Ultraintense Laser Light	3	Optional
Visual Optics and Biophotonics	3	Optional
SECOND COURSE		
Master's Thesis	16	Project