



VRIJE
UNIVERSITEIT
BRUSSEL

**MASTER OF
SCIENCE IN
APPLIED SCIENCES
& ENGINEERING**

COM PUTER SCIENCE

www.vub.be/computer-science

**120
ECTS**

2020-2021



WHY VUB?

VUB education shapes strong individuals, critical minds and world citizens

Vrije Universiteit Brussel (VUB) offers high-quality English-taught programmes, supported by state-of-the-art research. Being a student at VUB means learning in an open atmosphere of tolerance and diversity, as well as growing into an independent and critical-thinking individual.

VUB is a comprehensive university that offers education on student-friendly campuses in the cosmopolitan city of Brussels. At VUB, lecturers and assistants are available and approachable to students. Faculty members are on hand to answer questions and teaching often takes place in small groups to ensure close interaction and hands-on experience.

VUB is a dynamic and modern university with almost two centuries of history. We welcome more than 15.000 students, 21% of which are international students from more than 120 different countries.

The root of our academic success

Vrije Universiteit Brussel was founded on the principle of 'free inquiry' as formulated by the French mathematician and philosopher of science Henri Poincaré (1854-1912):

"Thinking must never submit itself, neither to a dogma, nor to a party, nor to a passion, nor to an interest, nor to a preconceived idea, nor to anything whatsoever, except to the facts themselves, because for it to submit to anything else would be the end of its existence."

Personal development, open-mindedness, a positive and critical attitude and a sense of responsibility are values that characterise everyone at our university: from professors and researchers to students and staff members. It lies at the root of our academic success.





Mastering computer science

This master programme is designed for students with a solid, fundamental academic background in computer science (such as a bachelor in computer science, or equivalent). It will provide you with a deeper knowledge and understanding of computer science in general, and one of four specialisations in particular. The programme prepares you for an active role in computer science research and development, in academia as well as in the ICT industry.

In addition to a meticulously designed core programme complemented by state-of-the-art specialisations, the curriculum offers a wide range of electives that allow you to tailor your education to your interests.

Our courses promote an active style of learning. As well as regular lectures, we use a broad range of instruction techniques, such as group and individual projects, seminars, workshops, talks by invited experts in the field, and research trainings.



MASTER OF COMPUTER SCIENCE @ VUB

Strongly embedded in ongoing research

Our courses and specialisations are strongly embedded in the ongoing activities of research groups that are each specialised in a particular domain of computer science. The groups publish in international journals and at international conferences, and participate in international research networks and projects.

Master students carry out at least half of their studies within one of these groups. By being part of a professional research team, students have the best opportunities to learn and develop scientific skills, and to participate in world-class research. The groups also have experience in developing research trajectories with societal and economic impact. They have implemented an active policy in technology and knowledge transfer, patenting, spin-off creation, industrial collaboration and innovation.

A truly international context

About half of the students in our master's programme come from Belgium; the other half come from all over the world. Courses are taught and guided by a similarly diverse mix of professors and assistants. The membership of the research groups is truly international, and you can communicate with the university administration in English. You can also go abroad during your studies to our prestigious partner universities in **Germany** (Bauhaus-Universität Weimar, TUM - Technische Universität München and Universität Konstanz), **Spain** (Universitat Politècnica de Catalunya),

Sweden (Chalmers University of Technology) and **Switzerland** (EPFL - École Polytechnique Fédérale de Lausanne or ETH Zürich). There are also multiple possibilities for an exchange semester outside of Europe.

A wide range of research topics

This master's programme is jointly organised by two departments, the Department of Computer Science at the Faculty of Science and the Department of Electronics at the Faculty of Engineering. Together, they employ more than 200 researchers, who cover a wide range of research topics.

Pathways to a successful career

After obtaining your master's degree, you are perfectly prepared for a high-level job in the ICT industry or for research in an academic or industrial context. You will have the expertise to enter a wide range of professional sectors, but no matter where you are employed, you are bound to find yourself at the cutting edge of technological innovation. You will be equipped with exactly these skills that are necessary for a successful career in high-end industry or academia: a sharp, inquisitive mind dedicated to pushing the boundaries of knowledge and human accomplishment.



| TWO YEAR PROGRAMME | ECTS |
|---|-----------|
| Methods for Scientific Research | 3 |
| Declarative Programming | 6 |
| Theory of Computation | 3 |
| Information Theory | 3 |
| Scientific Integrity | 3 |
| Software Architectures | 6 |
| Open Information Systems | 6 |
| Specialisation | 30 |
| Artificial Intelligence | |
| Multimedia | |
| Software Languages & Software Engineering | |
| Web & Information Systems | |
| Elective courses | 30 |
| Research training | 6 |
| Master's Thesis | 24 |

The programme is subject to change.

Check www.vub.ac.be/en/master-computer-science for the latest information about the programme.

ECTS (European Credit Transfer System):

1 credit represents 25-30 hours of study activity.

Outline of the programme - 120 ECTS

- A core of 30 ECTS
- One of four specialisations: Artificial Intelligence, Multimedia, Software Languages & Software Engineering, or Web & Information Systems. Each of these specialisations consists of a number of mandatory and optional courses; students should follow at least 30 ECTS within their chosen specialisation.
- 30 ECTS electives
These electives can be chosen from any of the four specialisations (regardless of the chosen specialisation).
6 ECTS can be taken from any of the master's level courses at the Vrije Universiteit Brussel.
- Research training worth 6 ECTS related to the chosen specialisation
- A master's thesis worth 24 ECTS related to the chosen specialisation

4 SPECIALISATIONS

Artificial Intelligence

The focus is on building intelligent software artefacts. We emphasise the theories of complex dynamic systems and self-organisation, starting from the theory of complex dynamic systems as developed in related fields, such as mathematics, physics and biology. As well as datamining and big data, students will be exposed to current research in the areas of adaptive systems, multi-agent systems, the origins of language and bioinformatics.

Multimedia

You will conduct in-depth exploration of techniques for signal processing and communication of multimedia content. The programme is designed to build thorough technological and scientific knowledge of various multimedia domains, such as digital television, telephony and videophony, computer animation, computer games and the internet. Students will gain experience of complex ICT architectures for the processing, distribution, and consumption of multimedia content.

Software Languages & Software Engineering

You will study languages, techniques, tools and methods to build complex software applications and software-intensive systems. In the practical part of most courses, you will apply this knowledge in the context of a wide variety of innovative hardware. We offer electives including theoretical foundations, specialised programming paradigms, virtual machines, advanced software engineering principles and the more process-oriented aspects such as agile development.

Web & Information Systems

This specialisation is geared towards information-system development, and application development in the context of the web. You will learn about data and semantic representation methods and techniques, data visualisation techniques, user interfaces and innovative user interaction techniques, and participate in research on innovative information systems, such as serious games, multi-modal interaction systems, innovative document systems, and large-scale data processing.

EXPERTISE @ VUB

AI LAB

Main study areas:

- Multi-agent systems (large groups of autonomous programmes trying to achieve a goal)
- Reinforcement learning (computer systems learning a task with only minimal feedback)
- Datamining (looking for interesting patterns in data)
- Learning of speech (computer systems learning the basic speech sounds of a language)
- Evolution of language (using computer models to understand how we developed language)
- Intelligent tutoring systems (systems that help people learn, focusing on language and music)
- Social evolution (how individuals cooperate and compete in strategic situations, game theory)
- Computational biology (modelling and simulation of biological, behavioural and social systems)

SOFTWARE LANGUAGES LAB

Main study areas:

- Programming Languages, Domain-specific Languages & Middleware
- Virtual Machines & Embedded Software Frameworks
- Static Analysis, Type Systems, Semantics of Languages
- Cloud-based & Web-oriented Development, Mobile Applications
- Reactive & Event-driven Programming
- Parallel & Concurrent Programming, High-Performance Computing
- Evidence-based Software Engineering
- Innovative Tools (Cloud-oriented debugging, Code Querying ...)
- Participatory Sensing & Crowd-sourcing frameworks

WISE LAB

Main study areas:

- Cross-media information spaces & architectures
- Serious games, e-learning & learning analytics
- Interactive paper & augmented reality solutions for bridging the digital & physical worlds
- Mobile & context-aware applications
- Multimodal & multi-touch interaction frameworks for new forms of natural or tangible user interfaces
- Intelligent human-computer interaction & virtual reality solutions
- Intelligible information visualisation
- Big data processing: distributed data processing, graph analytics

ELECTRONICS DEPARTMENT

Main study areas:

Multidimensional signal processing and communication (IRIS)

- SmartNets
- Computer/Machine Vision
- Multidimensional Signal Representation, Processing, Transmission, Visualisation & Forensics
- Medical Imaging & e-Health

Laboratory for Micro- & Photonelectronics (LAMI)

- Opto-electronics
- Analogue Circuit Design
- Life: Living Systems Project

Laboratory for Digital Speech & Audio Processing (DSSP)

- Digital Speech & Signal Processing
- Audiovisual Speech Processing



"Thanks to the diversity of courses taught in the Computer Science programme I was able to find and refine my interests in this very broad field. The Artificial Intelligence specialisation offered a challenging and interesting path into a subject that is embedded in nearly every new technological advancement.

The style of teaching pushed us to keep exploring beyond the course material, and allowed me to gain a deep familiarity with the latest research. There was an important emphasis on the foundations of Computer Science and Artificial Intelligence, something that helps me in my career when keeping up with the latest academic work."

Tom Jaspers, Google UK, London



ADMISSION CRITERIA

Admission is based on the review of each application: proof of meeting academic and language requirements, personal motivation, etc.

LANGUAGE REQUIREMENTS

Prospective students can provide proof of sufficient knowledge of English as language of instruction by meeting one of the following criteria:

- having successfully completed one of the following language proficiency tests:
 - TOEFL: minimum level 79 for the internet-based test (IBT)
 - IELTS: minimum level academic module 6.5
 - ITACE: minimum level B2
 - Cambridge English Qualification Scale: minimum level 170
- having successfully completed at least one year of secondary education with English as language of instruction, or having successfully completed secondary school in a Belgian institution;
- having successfully completed programme units in higher education with a minimum of 54 ECTS-credits where English was the language of instruction.

For more details on admission requirements and application: www.vub.be/en/apply

ACCESS

Application prerequisite for the programme Master of Computer Science is an academic bachelor's degree in Computer Science or equivalent. Equivalency and admission to the programme will be based on a review of the student's academic record and will be evaluated case by case. Entering in the second semester (February) is possible under certain conditions.

Application deadline

Prospective students are advised to apply as soon as possible, even if they have not yet obtained their degree. Applications can only be submitted through our website www.vub.be/en/apply

- Students who require a visa (non-EU/EEA nationals) need to submit their application before **April 1st**.
- Students who do not require a visa must apply before **September 1st**.
- Note: if the proof of English proficiency or APS certificate is not ready before the deadline, you can always submit it later instead of missing the deadline.

Tuition fees

All Flemish universities in Belgium are subsidised by the government, which results in relatively low tuition fees. The general tuition fee for our master programmes is €940/year. Some programmes have higher tuition fee for students with a non EU/EEA nationality. A detailed overview of the tuition fees can be found on:

www.vub.be/en/tuition-fees

Contact

www.vub.be/computer-science