



VRIJE
UNIVERSITEIT
BRUSSEL

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

APPLIED COMPUTER SCIENCE

www.vub.be/applied-computer-science

**120
ECTS**

2023-2024



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 21,500 students, 24% of which are international students from more than 152 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.





In the forefront of Data Science and Data Engineering

The Master in Applied Computer Science accepts students with a Bachelor's or Master's degree in Engineering or Exact Sciences and with a background in the various engineering disciplines. The accepted students need to have a sufficient background in programming and computer science such that they can reach the above stated objectives in a two-year master programme.

This programme aims to develop state-of-the-art computer science skills that will complement the student's primary field of expertise. The Smart Cities, Digital Health and Digital Earth modules respond to the demands of our digitalised world and to the latest trends in the data-science-related labor market, while the wide range of highly specialised elective courses gives students the opportunity to personalise their curriculum.

Moreover, there is a double degree option with the Technical University of Cluj-Napoca in Romania.



MASTER IN APPLIED COMPUTER SCIENCE (MACS)

Data science and data engineering

The programme focuses on the design and engineering of computer-based smart systems, spanning the entire associated technology spectrum from hardware technologies – including, sensors, actuators, electronic and photonic devices – to advanced networking and internet-of-things systems and to big data processing, management and analysis software technologies, including artificial intelligence, machine learning and data analytics. This field of ICT engineering sciences has been generally known as “data science and data engineering”. Data-driven systems are typically characterised by their multi-modal and multi-sensory nature, resulting in large multi-dimensional, distributed datasets that need to be efficiently processed, and of which the output needs to be (visually) represented in a consumer/prosumer friendly fashion. The programme offers theoretical insight into and practical experience on the disciplines involved in the end-to-end chain of current smart systems.

Prepared for a career as Data Scientist/ Engineer

The Master in Applied Computer Science provides a broad education in generic smart systems design, complemented by elective minors in important fields such as Smart Cities, Digital Health and Digital Earth. In addition, the programme offers students the skills to operate in other application domains such as the factory of the future, wearable technologies, smart homes, connected cars, smart retail,

smart agriculture, smart grids or food production systems. In general, the accumulated knowledge should prepare students for a career as a data scientist and data engineer who is able to design and optimize intelligent systems.

Personalise your curriculum

Computer science has become an area covering a wide scope of topics and application areas, which makes the programme highly customisable. In the first year, we focus on developing knowledge of computer science, IT and Artificial Intelligence. Elective courses in the second year allow students to apply the skills acquired in the first year to a specific field, such as software development, machine learning, data analysis, distributed computing. A master's thesis, and optionally an internship and/or a module on entrepreneurship are also included in the programme.

Interaction between researchers and students

This master's programme is organised by four departments: the Department of Electronics and Informatics, the department of Hydrology and Hydraulic Engineering (part of the Faculty of Engineering), and the Departments of Computer Science and Geography (part of the Faculty of Science). Together, the departments employ more than 200 researchers, covering a wide range of research topics. The excellent interaction between researchers and students enables intense student participation in development work and research projects.



MASTER YEAR 1	ECTS
Programming in Java	3
Operating systems & security	4
Scripting languages	3
Algorithms & data structures	5
Advanced IT Networks	6
Advanced programming concepts	3
Computer systems	4
Databases	5
Web technologies	3
Techniques of artificial intelligence	6
Compulsory courses (students must select one module)	18
Smart Cities or Digital Health or Digital Earth module	
MASTER YEAR 2	ECTS
Deep Learning	6
Distributed computing and storage	4
Soft Skills for Applied Computer Scientists	3
Tech. and Applications of micro- electronics and photonics.	6
Compulsory courses (students must select one module)	3
Elective courses	14
Choice from the list of elective courses AND/OR	
Courses from the Entrepreneurship module AND/OR	
Internship	
Master Thesis	24

ECTS (European Credit Transfer System):
1 credit represents 25-30 hours of study activity.

SMART CITIES

The Smart Cities module looks at logistics and mobility, with a focus on sustainable solutions. It covers modern software and systems engineering technology including embedded systems, sensor networks and the internet of things. The latest trends in big data and cloud computing are also covered in detail.

DIGITAL HEALTH

The Digital Health module provides a multidisciplinary view to smart systems engineering for the e-health and medical fields. Medical imaging, machine learning and medical informatics as well as advanced data analytics for connected health are covered in detail in this module.

DIGITAL EARTH

In the Digital Earth module, you will learn the latest smart system engineering methods, from modelling and remote sensing to image processing and machine learning, for addressing environmental problems such as climate change, water and food security, and air quality.

DOUBLE DEGREE

We offer a double degree with the Technical University of Cluj-Napoca (TUCN) in Romania. The specialization Business Intelligence is available only to students following this double degree and is awarded by TUCN. You will learn technologies and practices for the integration and analysis of business data that support business decision making.

The programme is subject to change.

Check www.vub.be/en/applied-computer-science for the latest information.

MACS PROGRAMME INTELLIGENT SYSTEMS ENGINEERING

INTELLIGENT SYSTEMS ENGINEERING COVERS EMERGING TECHNOLOGIES, INCLUDING THE INTERNET OF THINGS, BIG DATA, MACHINE LEARNING AND AI SYSTEMS, AND CLOUD/EDGE COMPUTING, LEADING TO THE RISE OF SMART CITIES, SMART AND SUSTAINABLE LIVING AND DIGITAL HEALTH.

Every minute, more than 100 hours of videos are uploaded to YouTube, more than 100,000 tweets are sent, and about 200,000 photos are shared on Facebook. Moreover, millions of networked sensors and actuators are being embedded in the physical world in devices such as mobile phones, smart energy meters and distributed cameras that sense and transmit data.

Furthermore, smart medical devices and sensors collect data from patients leading to massive electronic health records.

It is widely acknowledged that the effective use of such amounts of data has the potential to transform science and economy as well as to address profound societal problems such as climate change.

The McKinsey Global Institute points to \$300 billion in potential annual value to US healthcare and €250 billion in potential annual value to Europe's public sector.

The rapid growth of the IoT big data, AI and data analytics technologies has created a huge demand for skilled people in various disciplines.

A rough search in professional networking and job-seeking platforms, such as LinkedIn and Indeed, shows that the most in-demand positions

include ICT, machine learning and AI engineers, data architects, data analysts and data scientists.

It is clear that graduates who understand practical and fundamental methods of intelligent systems and machine learning, data mining and predictive analytics – will continue to be in high demand across all industries.

At the Department of Electronics and Informatics at Vrije Universiteit Brussel, we see intelligent systems engineering and data science as

key areas for the nearby future, and we have built an ambitious master programme. We recognise that the related job market will require both engineers with deep technical skills and analysts with the knowledge to use the analysis of big data for making effective decisions. The Master in Applied Computer Science has been developed to provide challenging learning opportunities for students in both these areas.

Prof Dr Ir Nikolaos Deligiannis,
programme director.

"Data science and big data analytics: key areas to develop"

"Graduates who understand practical and fundamental methods of intelligent systems and machine learning, data mining and predictive analytics – will continue to be in high demand across all industries."



*"Students in the programme
come from different continents.
I feel like I'm teaching the world.
And I like it."*

Prof. Dr. Johan Stiens, head of the Electronics
and Informatics department

ADMISSION CRITERIA

Admission is based on the review of each application (including proof of meeting academic and language requirements, personal motivation, etc.) as well as an online interview with a faculty member.

LANGUAGE REQUIREMENTS

Having a diploma of secondary or higher education where English was the language of instruction;

Having successfully completed secondary education organised (by an educational establishment accredited) by the Flemish, French-speaking or German-speaking Community;

Having successfully completed one of the following language proficiency tests corresponding to the Common European Framework of Reference with minimum level B2:

- TOEFL iBT with minimum level: 79;
- IELTS with minimum level: academic module 6.5;
- ITACE with minimum level: B2;
- Cambridge English Qualification Scale with the following minimal level: 170.

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

SPECIFIC ADMISSION CRITERIA

This programme is intended for students who have completed an academic bachelor's or master's degree in engineering or exact sciences. Admission is based on acceptance and will be evaluated on a case-by-case basis. The admission process also includes an interview with a faculty member.

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 €979,60/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

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