



Postgraduate Certificate in **Smart Operations and Maintenance in Industry**

September 2024 - June 2025

Digital transformation is taking place worldwide at an ever accelerating pace. This new phase in the development of industry, also coined 'the Fourth Industrial Revolution' or 'I4.0.', brings complex issues, but also enormous opportunities. After all, the leading trends in the field of digitalisation result in new products, new ways of producing with more robust production lines, and even new business models.

Internet of Things, artificial intelligence, big data, cloud computing, 3D printing, virtual & augmented reality, ... these are all concepts that are ubiquitous in the discourse on the industry of the future. However, few people are able to explain how the technologies behind these buzzwords work in practice, how to implement them in our factories, and how to use them in a 'smart' way. Indeed, technology is becoming more and more complex, which means that the demand for techn(olog)ical knowledge about production processes is increasing. Especially IT technologies make I4.0 possible. Information and data technologies constitute a big part of modern manufacturing, and there is a growing use of complex so-called 'cyber physical systems'. Traditional fields of 'engineering' and 'IT' are becoming complementary, especially in production environments. In addition, the work context is increasingly challenging: I4.0 implies a very dynamic way of working, in which human-machine interaction plays a major role.

On the labour market, these (r)evolutions are translated into a need for new profiles with competences to successfully implement the transformation towards Industry 4.0. The postgraduate studies in Smart Operations and Maintenance (O&M) in Industry allows engineers to specialise in the field of Smart O&M. The programme is developed to equip recent graduates, professionals, and international students with solid academic knowledge of the most essential concepts and technologies in Smart O&M.

This postgraduate programme is jointly organised by Ghent University and KU Leuven. It stands firmly on its own, but also opens the door to more. The programme forms an integral part of the Advanced Master of Science in Smart Operations and Maintenance in Industry, in which students can register for one of three in-depth and hands-on elective tracks, and further improve themselves as Smart O&M specialists. Participants who successfully complete the courses in the postgraduate programme will be granted exemptions in pursuing the homonymous advanced master's degree.

[Discover our programme](#)

AIM OF THE PROGRAMME

Industry is digitally transforming, and actionable intelligence is key to implement the right technologies in a broader transformation strategy.

This postgraduate programme is jointly organised by Ghent University and KU Leuven. It focuses on the most relevant and essential industry 4.0 (I4.0) technologies and concepts related to operations and maintenance, for an industrial production context.

‘Operational excellence’ is an omnipresent objective in industry and is especially relevant for operationally intensive sectors, such as the manufacturing industry. They are subject to the I4.0 transformation, because operations in particular lend themselves to (flexible) automation.

Operations are inextricably linked to the maintenance phase. Maintenance is aimed at allowing operational processes to run as smoothly and undisturbed as possible by ensuring that all equipment and infrastructure required for production is always working 100% efficiently.

This programme teaches how both operational and maintenance processes can be optimised by making them ‘smart’, using new (I4.0) technologies, such as robotics, big-data analytics, digital twins, cloud computing, etc. The programme covers technologies that facilitate an advanced digitalisation of product and process information (e.g., smart sensors), technologies that are used in production and maintenance (e.g., cobots), and technologies that connect production equipment/assets and people (e.g., Industrial IoT platforms).

TARGET AUDIENCE AND ELIGIBILITY

The postgraduate programme Smart O&M in Industry aims at three different kinds of engineers:

1. Recently graduated students
2. Professionals
3. International students

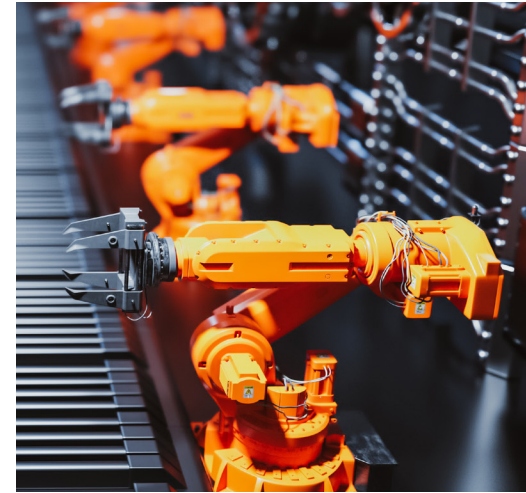
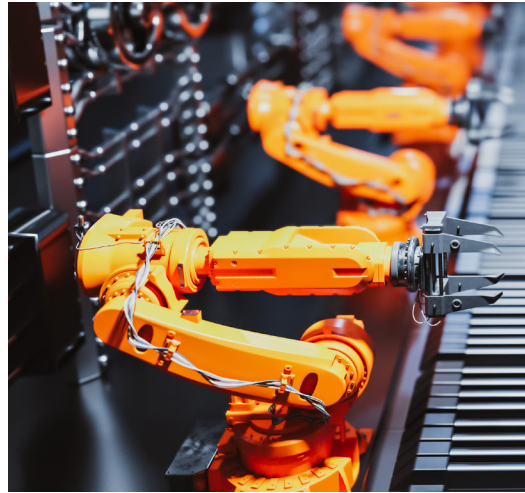
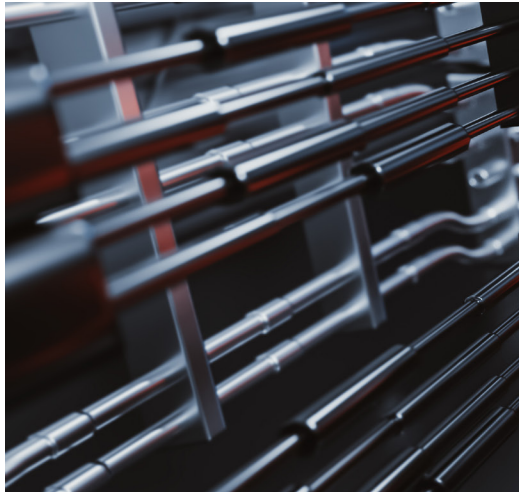
Immediate admission is granted to those holding a master’s degree in Engineering Science or Engineering Technology with majors in Mechanical Engineering, Electrical Engineering, Electromechanics, Machine and Production Automation, Electronics-ICT, Energy, and Business Systems Engineering and Operations Research.

If you do not hold one of the aforementioned master’s degrees, or if you hold a degree in an entirely different field of study, your application will still be considered if you can demonstrate the necessary academic requirements, equal to having a solid engineering background, through a CV and letter of motivation. The interuniversity programme committee will assess your application.



COURSES

Advanced
Master's
level



DIGITAL TWIN (6 ECTS)

High computing power at low costs, reliable and high bandwidth sensorisation and communication, and new computational modelling techniques have enabled us to simulate **the physical world in a virtual one**.

It has led to the Digital Twin concept, a virtual replica that acts identically as a physical asset and remains synchronised with the asset during the lifecycle.

This opens up a **plethora of possibilities**, e.g. it can be used to optimise system parameters on the fly, to check the system's condition live, or to virtually explore future design improvements.

Through lectures and illustrative use cases, this course gives students an in-depth view on how to define a Digital Twin, its essential building blocks, and how to validate and use it to create added value in an industrial setting.

MONITORING AND PROGNOSTICS (6 ECTS)

One of the key methods to improve industrial processes is an **enhanced usage of current machinery**.

By **monitoring** the physical signals emitted by machine elements, it is not only possible to distinguish between a healthy and faulty machine, but also to predict when failing would occur.

Monitoring and prognostics optimise the need for replacement parts, reduces maintenance efforts, and increases machine reliability, which in turn makes factory maintenance and management **easier, more efficient and more cost effective**.

Through theoretical lectures, real-life cases and practical applications, students learn which physical signals are the most relevant, how to detect, acquire and analyse them, and how to relate these signals to potential failure.

OPERATIONS MANAGEMENT STRATEGIES (6 ECTS)

This course introduces students to the complex world of management strategy formulation for one of the main domains of a manufacturing company, i.e. operations. The course describes the **components and drivers for operations management** in a contemporary business context. Challenges are identified and the role of new and emergent smart technologies is explored. The course zooms in on **production and maintenance**, two important pillars in operations management.

Students learn about the **different types of strategies** possible for both production and maintenance, its essential concepts and opportunities, historical evolutions as well as the outlook. The course also teaches how to follow up performance, since it is imperative for all businesses to have quantitative tools to measure, monitor, check and predict the performance of their operations management.

SMART FACTORY DESIGN (6 ECTS)

New technological evolutions are drastically changing the way factories can and need to operate. The so-called "**smart factories**" have a **highly digitalised shop floor** that continuously collects and shares data through connected devices, machines, and production systems. These data can be used to **(self-)optimise** operations and to proactively address issues, improve manufacturing processes and respond to new demands by tapping the built-in reconfiguration potential.

Students learn how to design factories in a smart way, and how factories can be re-designed to become smart. **A lot of digital tools** are available to support factory design processes based on 3D digital models, which are virtual replicas of the (envisioned) real factory and can evolve towards digital twins in the operational phase to facilitate decision-making (e.g. what-if scenario analysis).

PRACTICAL INFORMATION

Schedule

The programme runs from 24 September 2024 until 20 May 2025, excluding the final examination period. Sessions are taught in English and scheduled on Tuesdays from 15:00 until 19:15, and on Thursdays from 12:30 until 20:00 in the first semester, and until 15:00 in the second semester. Tutors will make optimal use of educational technology to guarantee an optimal combination of work and study, and to maximise engagement and interaction.

Location

Two locations, both close to the railway station and equipped with virtual classrooms. Blended learning possibilities further strengthen the multi-campus approach, and allows top experts from all over Flanders to sporadically contribute to teachings in a hybrid way.

KU Leuven Bruges Campus

Spoorwegstraat 12
8200 Bruges
(1st semester)

Ghent University Campus Kortrijk

Sint-Martens-Latemlaan 2B
8500 Kortrijk
(2nd semester)

Registration

There is an **online registration system** to enrol for this programme. Please visit www.smart-OM.eu for more information.

Registration fee: € 4.150,00, which includes digital course materials, a KU Leuven and Ghent University student card and benefits.

Postgraduate certificate

After successful completion of the programme, you receive the Postgraduate Certificate: Smart Operations and Maintenance in Industry, awarded by KU Leuven and Ghent University. The programme contains 24 ECTS. Participants who successfully complete the courses in the postgraduate programme will be granted exemptions in pursuing the homonymous advanced master's degree.

More information

www.smart-OM.eu
info@smart-OM.eu

With the support of the Flemish Government



Flanders
State of the Art

The development of this programme was financially supported by the Flemish Government, to give a boost to Lifelong Learning initiatives in West Flanders.



KU LEUVEN BRUGES CAMPUS

KU LEUVEN

CAMPUS BRUGGE

For more information about the campus in Bruges, please visit www.kuleuven.be/campussen/campus-brugge

KU Leuven Bruges Campus is home to **programmes** from two faculties: next to the Faculty of Engineering Technology there is the Faculty of Movement and Rehabilitation Sciences. Currently, around 600 students are enrolled at Bruges Campus.

The campus houses two state-of-the-art Machine & Mechatronics labs: **'The Ultimate Machine'** and **'The Ultimate Factory'**.

In 'The Ultimate Machine', machines can be designed, optimised and validated under the influence of vibrations, errors, temperature fluctuations and electromagnetic disturbances. Here, performance, reliability and functional safety are of paramount importance. The second lab, 'The Ultimate Factory', comprises a concept factory that consists of several self-organising plug and play systems. These are machines that can be flexibly connected and disconnected within a broader production environment. As such, it is the ideal setting to easily test and experiment with innovative concepts from Industry 4.0.

GHENT UNIVERSITY CAMPUS KORTRIJK



GHENT UNIVERSITY
CAMPUS KORTRIJK

For more information about the campus in Kortrijk, please visit www.ugent.be/campus-kortrijk

Ghent University organises three full-fledged academic programmes on its campus in Kortrijk: Industrial Design, Machine and Production Automation, and Circular Bioprocess Technology.

The campus houses two high-tech Machine & Mechatronics labs the **'Production Automation'** lab and the **'Machine Automation'** lab.

The Production Automation lab houses the application lab **'Smart Production Organisation'**, which focuses on the use of digital tools to support engineering and optimisation projects for production and logistics installations. The eye-catcher is the 180° video wall of the digital twin control room. Secondly, the application lab **'Smart and flexible assembly/production'** which focuses on all kinds of flexible automation technologies. The second one, the 'Machine Automation' lab, allows to validate and refine modelling of several industrial machines. The machines are equipped with state-of-the-art sensors and provided with the necessary communication infrastructure to connect to the cloud.



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ENGINEERING SCIENCE



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ENGINEERING TECHNOLOGY



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