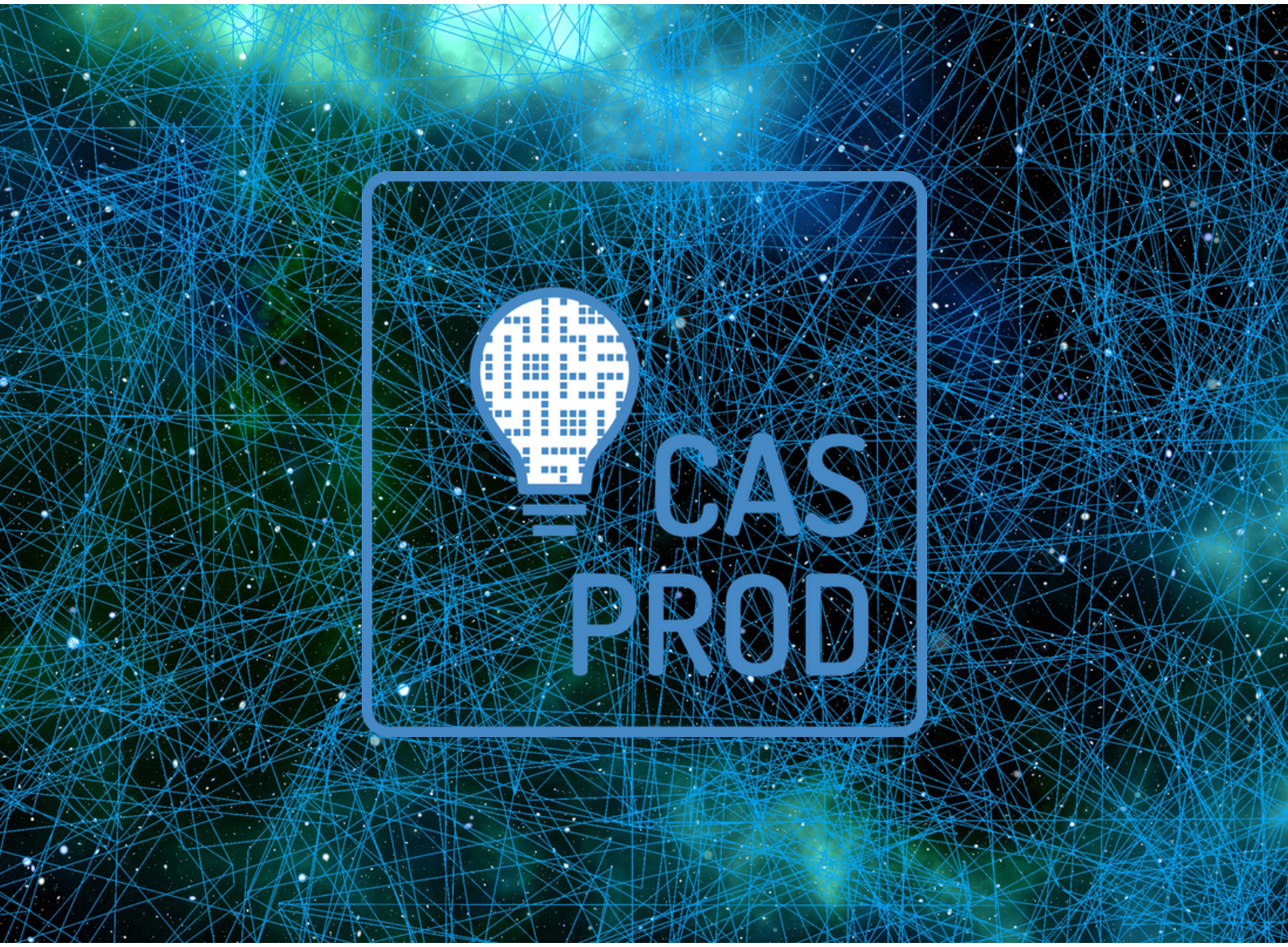
ERASMUS+ PROJECT

CAPITALS OF SMART PRODUCT DEVELOPMENT



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CAPITALS OF SMART PRODUCT DEVELOPMENT

About Erasmus+ CASProD project

Emerging complexity of modern design and engineering problems and their strong interaction with nature, environment, and society led to the situation where it is no longer sufficient for an engineering professional to be only competent in the narrow field of specific engineering, solving partial engineering problems assigned to him or her. The modern engineer has to understand the whole new product/service development process and foresee all aspects of product's interaction with the environment (cultural, economic, ecological, social, psychological, etc.).

The main goal of this project is thus to develop and accredit an innovative engineering master programme, which will teach students previously mentioned trends in theory and practice of smart product development, which will foster development of their transversal skills, including working in multi-disciplinary, multi-national, and multi-cultural environments, helping them to gain real industrial and entrepreneurial experience and making contacts for their future professional careers.

Project connects academic professionals from three European contries in order to achieve development and international accreditation of Smart Product Development Master joint master programme.

LJUBLJANA, SLOVENIA

ON THE SUNNY SIDE OF THE ALPS

Slovenia's capital with almost 300.000 inhabitants.

295 m above sea level

On average 1716 hours of sunshine annualy.

The first impression a visitor gets of Ljubljana is that it is an exceptionally young city. It is home to over 50,000 students, who give it a special vibe. As four Slovene regions meet in Ljubljana, the city's numerous restaurants and inns offer a wide range of local delicacies, not to mention superb wines. Ljubljana did not earn the label of "the city of wine and vine" for nothing. In the past it was the wine-trading centre of the region and grapevines were planted on the slopes leading up to the present-day castle by the inhabitants of the Roman settlement of Emona. Today scientists are drawn to the city because of its high-calibre institutes and university, as are artists due to its world-famous graphic biennial, art academy and countless art galleries. International businessmen, economists and experts from all fields frequently attend the city's many business and congressional meetings, exhibitions and trade fairs.

PROJECT COORDINATOR

UNIVERSITY OF LJUBLJANA, FACULTY OF MECHANICAL ENGINEERING (UL)

The Ljubljana Faculty of Mechanical Engineering exists to create and disseminate knowledge that enables its students and research partners to competitively participate in the international scientific field and marketplace. The vision of the Ljubljana FME is to become the premiere teaching and research faculty for mechanical engineering in Slovenia and Southeast Europe while maintaining the highest educational and professional Standards. With this the faculty will become be an even stronger magnet for the cooperation with Slovenian and international companies and research-and-development organizations. FME is one of the constituting CASProD partners, and as project coordinator actively involved in developing the programme. The project is managed by LECAD, Laboratory for Computer Aided Design.

KEY STAFF ON THE PROJECT:

- Assistant professor Nikola Vukašinović

ZAGREB, CROATIA

"IF THE CITY'S PARKS AND GARDENS ARE HAVENS OF TRANQUILLITY, ZAGREB'S SQUARES, WHEN NOT OCCUPIED BY GARDENS, ARE PLACES WHERE THE CITY'S HEARTBEATS ARE HEARD THE LOUDEST." - ANITA RAO-KASHI

Croatian's capital with more than 800.000 inhabitants

158 m above sea level

On average 1802 hours of sunshine annualy.

The city of Zagreb, capital of Croatia, on the historic and political threshold between East and West, illustrates both the continental and Mediterranean spirit of the nation it spearheads. Zagreb is the cultural, scientific, economic, political and administrative centre of the Republic of Croatia, and is home to the Croatian Parliament, Government and President. Its favourable location between the Pannonian plain, the edge of the Alps and the Dinaric range has allowed it to become a crossing point for mass international communication. The city is protected from the cold northern winds by the mountain of Medvednica and opens up to the rest of the world thanks to a spacious plain and the Sava river. Zagreb contains almost a quarter of the entire population of Croatia.

PROJECT PARTNER

UNIVERSITY OF ZAGREB, FACULTY OF MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE (UZ)

The primary objective of the Chair today is developing creative and innovative potential of students of mechanical engineering, naval architecture, and aerospace engineering through a series of coursescomprehending methodical design, development of innovative products and services and CA tools to support the development process. During the undergraduate study, the students are acquainted with the most advanced methodology, tools and practical and theoretical knowledge used in the development of the technical systems. At the graduate level of the study, the number of specialised courses is offered with emphasis to the integration and application of the acquired knowledge through project assignments, and diploma work topics are regularly complex engineering problems from the industry.The scientific work of the Chair and collaboration with industry through a number of R&D projects is focused on advanced models, methods and tools for management of engineering knowledge and innovation in the sustainable development of socio-technical systems.

KEY STAFF ON THE PROJECT:

- Professor Mario Štorga
- Assistant Professor Stanko Škec

VIENNA, AUSTRIA

"THE STREETS OF VIENNA ARE PAVED WITH CULTURE, THE STREETS OF OTHER CITIES WITH ASPHALT." ~ KARL KRAUS

Austria's capital with almost 1.900.000 inhabitants

151 m above sea level

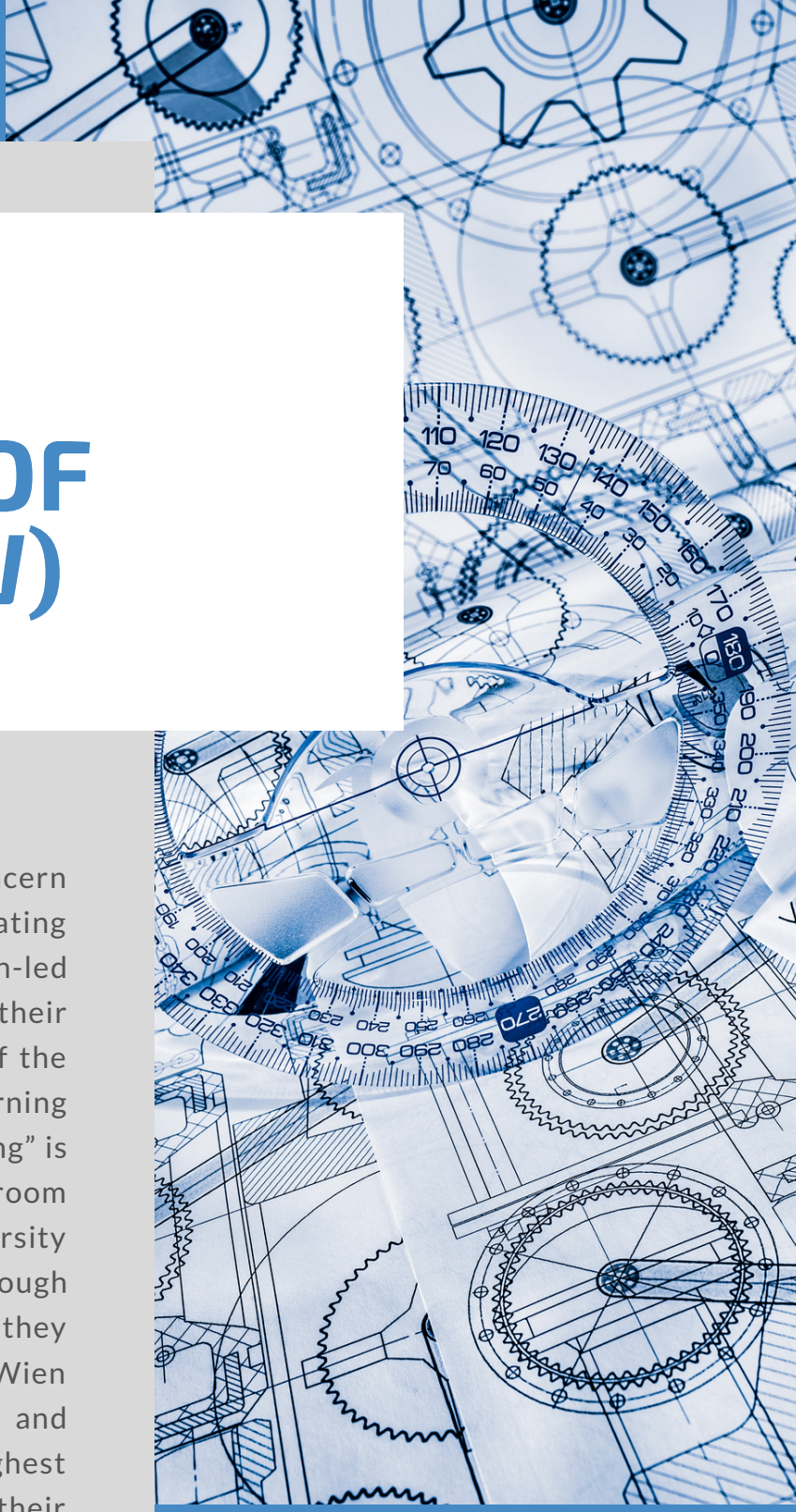
On average 1771 hours of sunshine annualy.

In the heart of Europe lies Vienna, capital of Austria and historic imperial city. With a population of almost 2 million people, the city is a real melting pot of numerous nations and cultures. The city's climate is oceanic, which means that you'll mostly enjoy nice weather whenever you decide to visit.

Vienna's history dates back to the first post-Christian century when the Romans established the military camp Vindobona. Today's cityscape is characterised by the abundance of Baroque buildings created mostly under the rule of Empress Maria Theresia (1740 - 1780) and Franz Joseph (1848 - 1916), who was largely responsible for the monumental architecture round the Ringstraße.

PROJECT PARTNER

TECHNICAL UNIVERSITY OF VIENNA (TUW)



A high-quality education is a primary concern to TU WIEN. Therefore, they aim at integrating research results in the sense of research-led teaching as essential components in their courses in addition to the current state of the art. By implementing modern e-learning methods, the potential of “Blended Learning” is exploited within a sensible mix of classroom and online teaching. Techincal University Vienna builds their reputation through research. The content of the teaching they offer is based on this research. TU Wien combines basic and applied research and research-oriented teaching at the highest level. Through their knowledge and their strong relationships, their graduates and scientists contribute to the transfer of knowledge and technologies across society and the economy.

KEY STAFF ON THE PROJECT:

- Professor Manfred Grafinger

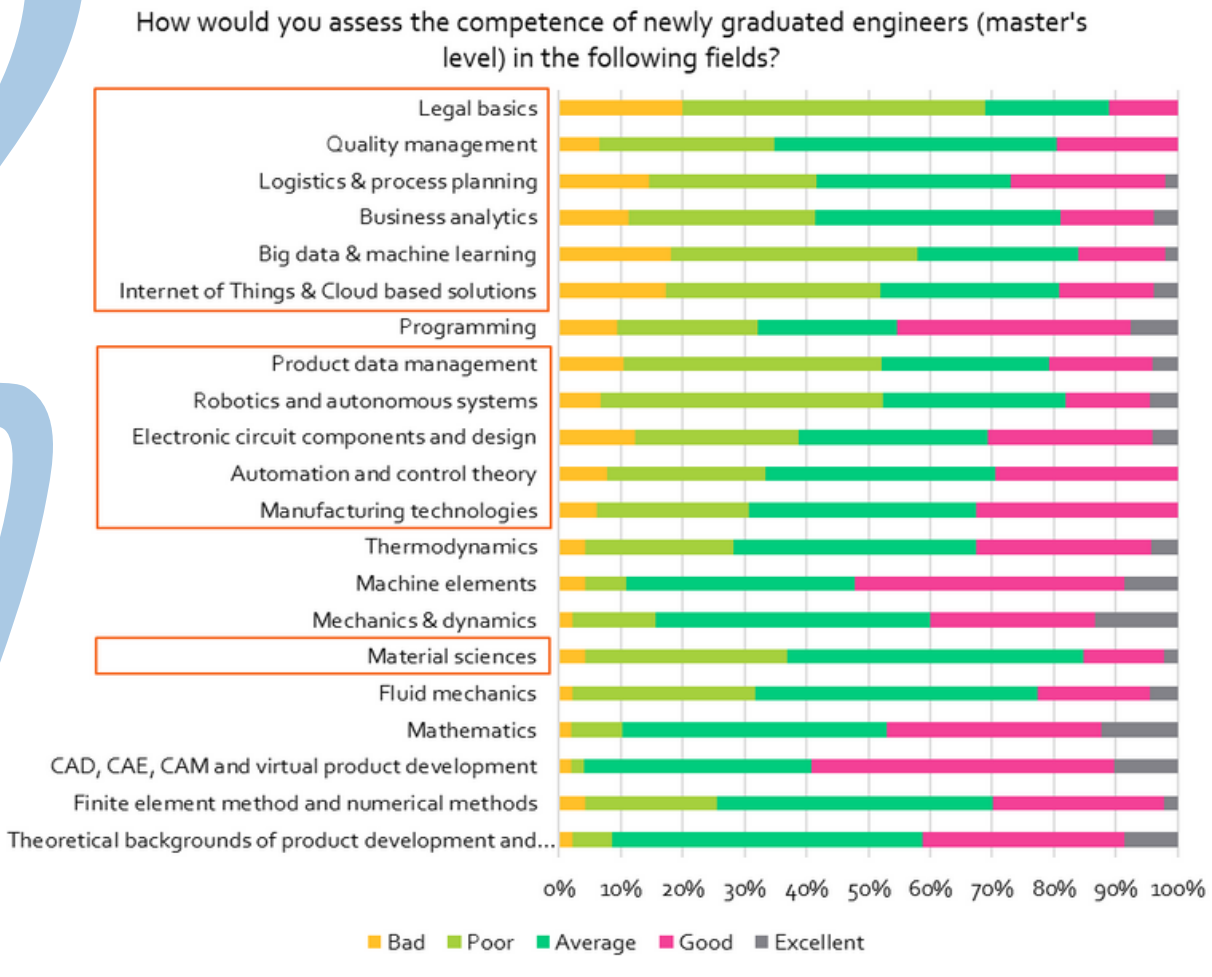
JOINT MASTER PROGRAMME

BACKGROUND

Industrial survey was performed by all project partners for the purposes of new master study curriculum preparation in order to identify the needs for new engineers in Austria, Croatia and Slovenia. 58 people participated, who are from various fields of knowledge and company positions, but mostly from different fields of mechanical engineering.

COMPETENCES OF FRESH ENGINEERS

As expected, the traditional knowledge (the knowledge of machine elements and various CAD technologies) was well represented. Subject Material science usually gives very fundamental knowledge about materials, with a huge emphasis on steel and iron, however engineers, who are dealing with product development need deeper knowledge on principles of proper material selection and availability and properties of different construction materials. There was a significant lack of transitive knowledge; therefore we emphasize improvements in that field – especially by implementing subjects about entrepreneurship, innovation, legal basics, management and business.



JOINT MASTER PROGRAMME

COURSE AND CURRICULUM

The joint master programme between University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture (UZ), University of Ljubljana, Faculty of Mechanical Engineering (UL), and Technical University of Vienna, Faculty of Mechanical Engineering (TUW) is divided into **4 semesters, 30 ECTS** each.

- **1st semester:** University of Zagreb
- **2nd semester:** University of Ljubljana
- **3rd semester:** TU Wien
- **4th semester:** Master thesis at UZ, UL or TUW

The contents of the programme are structured into 6 streams of different disciplines:

- **Stream 1:** Product development
- **Stream 2:** Digital Manufacturing & Information Systems
- **Stream 3:** Big Data Systems
- **Stream 4:** Innovation & Entrepreneurship
- **Stream 5:** Transferable Skills
- **Stream 6:** Integration Project

1st semester (UZ) obligatory courses

	Str1: Prod.dev.	Str2: Dig.Manuf. & Inf.sys	Str3: Big data sys.	Str4: Innov.&Entrep.	Str5: Transf. Skills	Integration project	Electives
Computer Integrated Products Development						4	
Mechatronics and Sensors Systems	5						
Digital Manufacturing Sytems		5					
Advanced Engineering Informatics			4				
Innovation Management in Product Development				4			
Design for Sustainability					4		
Elective 1							4

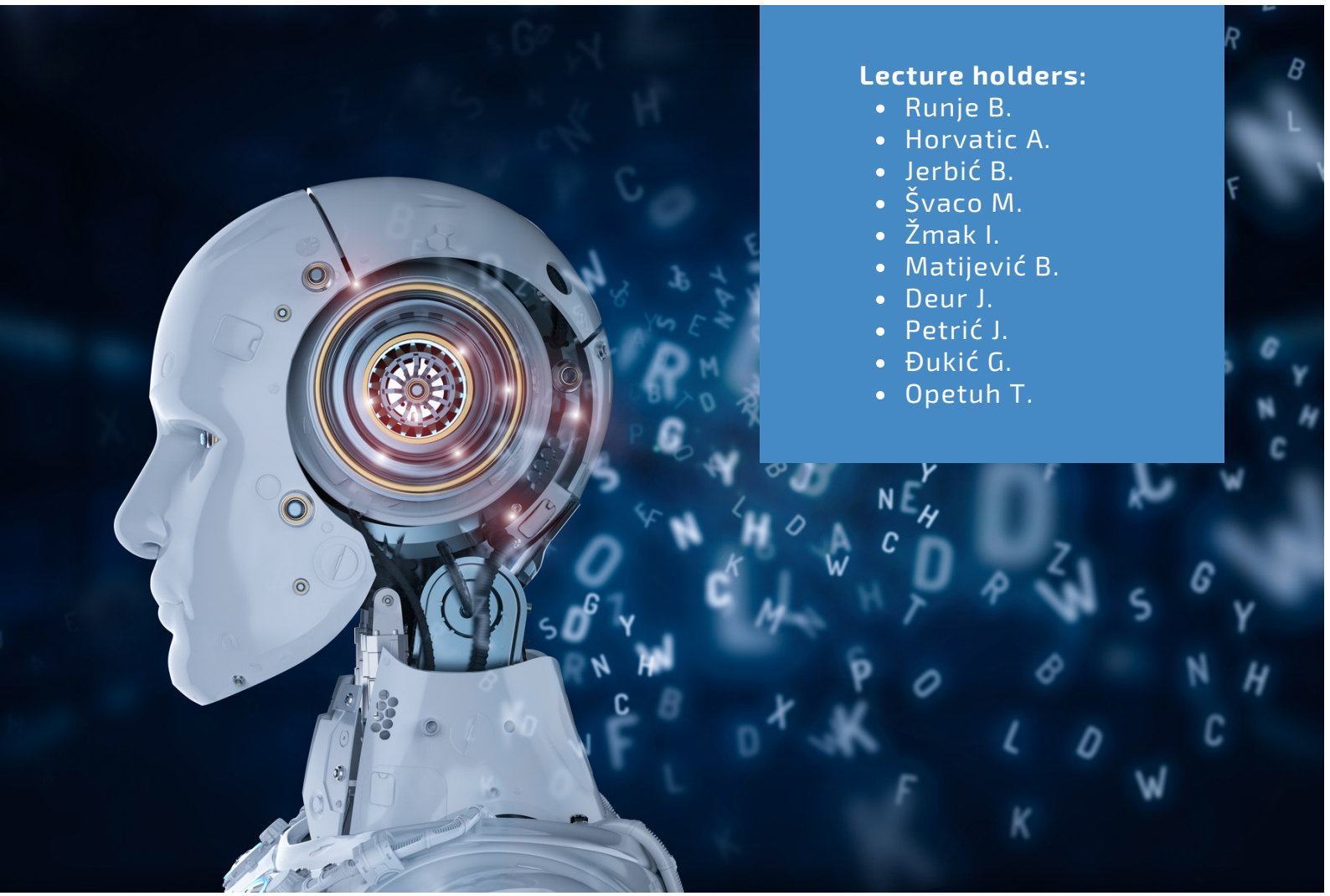
Smart, interconnected products offer opportunities for new functionality, reliability and product utilization. Design and development process of such products require engineers, technicians and other staff not to be only specialised in one core profession but to acquire additional portfolio of multidisciplinary knowledge and skills. Furthermore, product development rarely runs in single company, even not in single country. This leads to enhanced collaboration requirements and therefore, respective workforce skills.

Lecture holders:

- Štorga M.
- Škec S.
- Petrić J.
- Pavković D.
- Staroveški T.
- Brezak D.
- Bojčetić N.
- Pavković, N.

1st semester (UZ) elective courses

	Str1: Prod.dev.	Str2: Dig.Manuf. & Inf.sys	Str3: Big data sys.	Str4: Innov.&Entrep.	Str5: Transf. Skills	
Quality Management in Engineering				4		
Biomimetic Systems and Humanoid Robotics		4				
Advanced Materials	4					
Electric and Hybrid Vehicles	4					
Engineering Logistics				4		



Lecture holders:

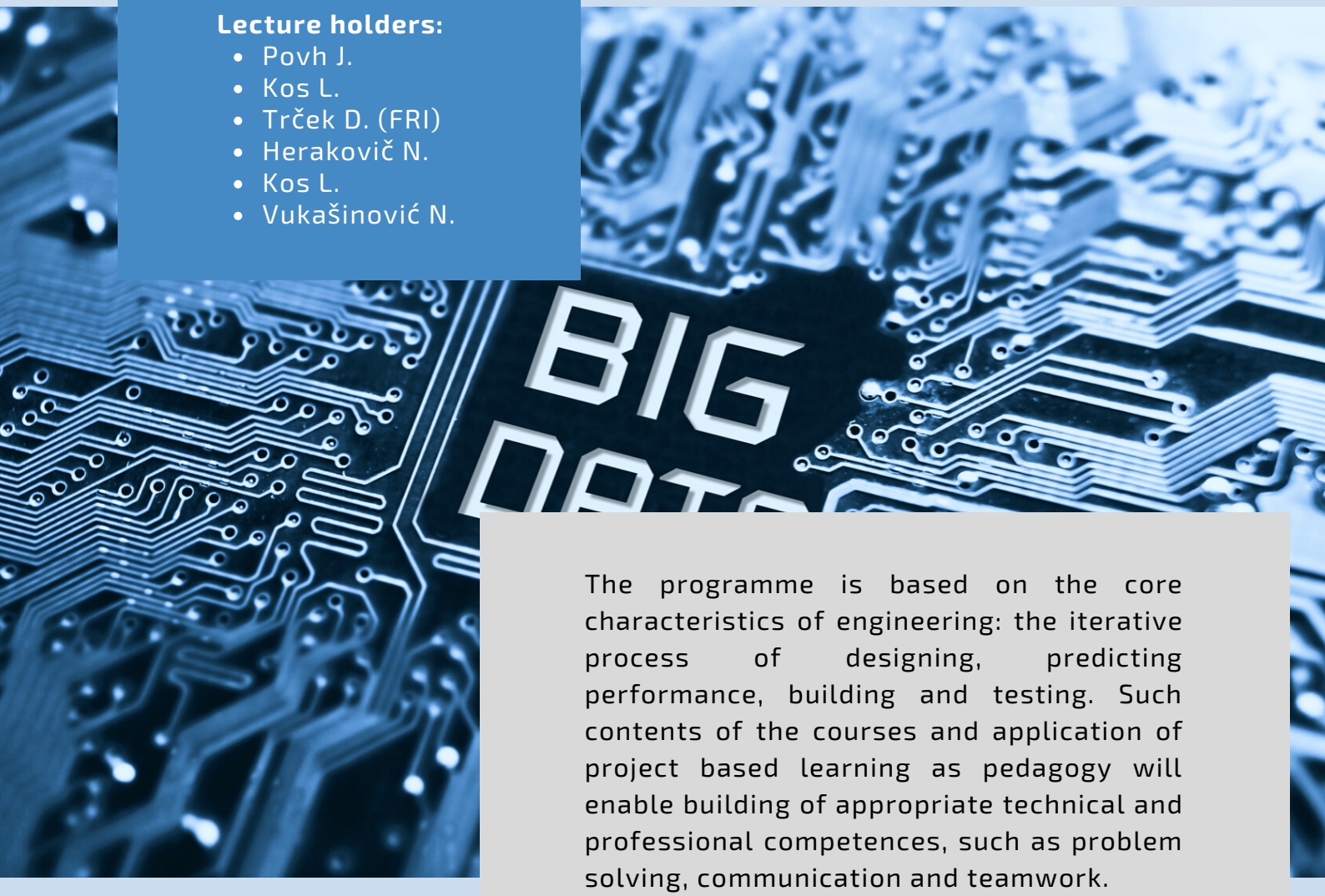
- Runje B.
- Horvatic A.
- Jerbić B.
- Švaco M.
- Žmak I.
- Matijević B.
- Deur J.
- Petrić J.
- Đukić G.
- Opetuh T.

2nd semester (UL) obligatory courses

	Str1: Prod.dev.	Str2: Dig.Manuf. & Inf.sys	Str3: Big data sys.	Str4: Innov.&Entrep.	Str5: Transf. Skills	Integration project	Electives
Data modelling			5				
Big data analysis			5				
Information Security and Privacy		5					
Assembly and handling systems	5						
Engineering design techniques						5	
Elective 2							5

Lecture holders:

- Povh J.
- Kos L.
- Trček D. (FRI)
- Herakovič N.
- Kos L.
- Vukašinović N.



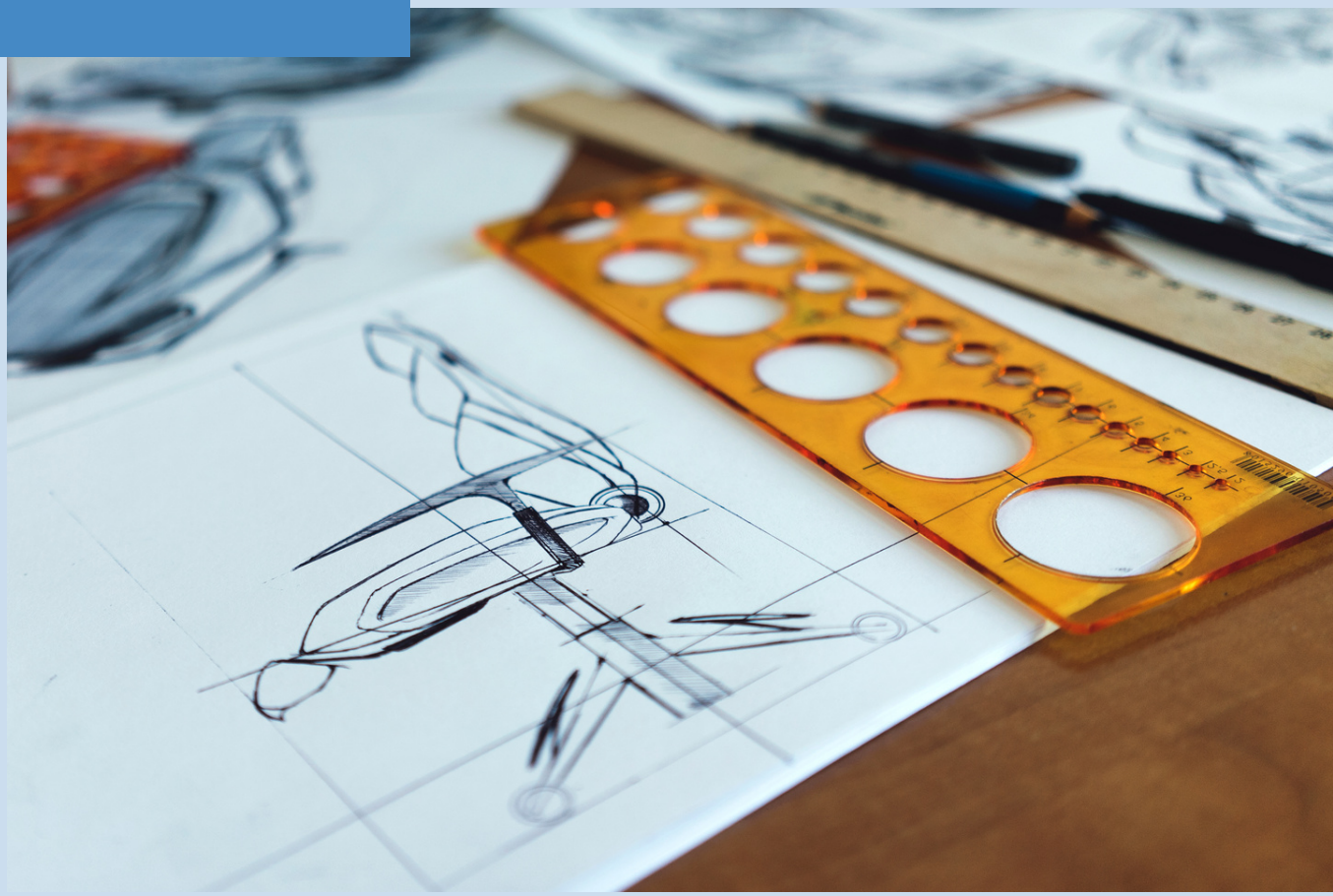
The programme is based on the core characteristics of engineering: the iterative process of designing, predicting performance, building and testing. Such contents of the courses and application of project based learning as pedagogy will enable building of appropriate technical and professional competences, such as problem solving, communication and teamwork.

2nd semester (UL) elective courses

	Str1: Prod.dev.	Str2: Dig.Manuf. & Inf.sys	Str3: Big data sys.	Str4: Innov.&Entrep.	Str5: Transf. Skills	
Mechatronic prototyping	5					
Multisensory systems, machine vision		5				
Design with non-metallic materials		5				
Distributed systems	5					

Lecture holders:

- Vrabič R.
- Podržaj P.
- Vukašinović N.
- Pepelnjak T.



3rd semester (TUW) obligatory courses

	Str1: Prod.dev.	Str2: Dig.Manuf. & Inf.sys	Str3: Big data sys.	Str4: Innov.&Entrep.	Str5: Transf. Skills	Integration project	Electives
Virtual Product Development	5						
Industrial Manufacturing Systems		4					
Industrial Information Systems		5					
Controlling, Project and Process Management				5			
Innovation Theory				3			
Project Work Virtual Product Development						5	
Elective 3							3

Lecture holders:

- Grafinger, M.
- Gerhard, D.
- Kittl, B.
- Bleicher, F.
- Schwaiger, W.
- Schlund, S.
- Filzmoser, M.

Students have to select also among selective subjects in minimum amount of 13 ECTS evenly distributed over the first three semesters, and thus increase emphasis on any of first five streams.

3rd semester (TUW) elective courses

	Str1: Prod.dev.	Str2: Dig.Manuf. & Inf.sys	Str3: Big data sys.	Str4: Innov.&Entrep.	Str5: Transf. Skills	
E-Tutoring, Moderation of E-Learning				3		
Further Education and Lifelong Learning				3		
Communication and Rhetoric				3		
Human Resource Management and Leadership				3		
Design of Information Systems for Production Management		3				
Marketing Basics				3		

Lecture holders:

- Herbst, I.R.
- Rakoczi, G.
- Csanyi, G.
- Pichlmair, M.
- Köszegi, S.
- Erol, S.
- Ansari, F.
- Grasser, T.

4th semester thesis

The fourth semester will be dedicated to master thesis and will be held at the university according to student's preferences regarding the contents of the master thesis.

JOINT MASTER PROGRAMME

TRENDS AND COMPETENCES

There are two main identified shifts in product development process:

(1) the increased interdisciplinarity of the process;
(2) shorter development cycle.

Both shifts result in needs for outsourcing different sub-tasks and in need to gather and analyze more data in shorter time. There exist successful tools and methods to tackle these changes, however, the students usually meet them for the first time only when they get first industrial experience.

The students who will successfully pass all four semester of the International Joint Master Programme will hold professional knowledge, skills and competences to successfully tackle this shifts and will be ready for the challenges that the new product development process wil bring in the forthcoming years and decade. They will be ready to independently solve complex industrial or scientific questions and will have the skills to work confidently in multidisciplinary teams.

Erasmus+
CASProD

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Faculty of Mechanical Engineering

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University of Zagreb,
Faculty of Mechanical Engineering and Naval Architecture

Professor Mario Štorga – mario.storga@fsb.hr
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TU Wien,
Faculty of Mechanical and Industrial Engineering

Professor Manfred Grafinger – manfred.grafinger@tuwien.ac.at