



FACULTY OF TECHNOLOGY AND METALLURGY
UNIVERSITY OF BELGRADE



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The Faculty of Technology and Metallurgy, University of Belgrade is the leading and the oldest accredited higher education, scientific and research institution in our country and the region in the field of chemical technologies.

Along and rich tradition of almost 100 years, over 12,000 graduate engineers, more than 2,100 master engineers and 1,300 PhD graduates educated at our Faculty, world-recognized scientific results and reputation, as well as human and material resources of the Faculty are a testimony to the high quality of scientific and educational practices at the Faculty.

The Faculty educates professionals within

- 5 study programs at the bachelor level (bachelor studies, BSc),
- 6 study programs at the master level (master studies, MSc),
- 6 study programs at the doctoral level (doctoral studies, PhD):

LEVEL OF STUDIES	BSc	MSc	PhD
ECTS	240	60	180
DURATION	4 years	1 year	3 years
STUDY PROGRAMS	Chemical engineering	Chemical engineering	Chemical engineering
	• Chemical process engineering • Pharmaceutical engineering • Organic chemical technology • Polymer engineering • Inorganic chemical technology • Quality control • Electrochemical engineering	• Chemical process engineering • Pharmaceutical engineering • Organic chemical technology • Polymer engineering • Inorganic chemical technology • Quality control • Electrochemical engineering	
	Materials engineering	Materials engineering	Materials engineering
	• Materials engineering • Graphic engineering, design and packaging • Textile engineering	• Materials engineering • Graphic engineering, design and packaging • Textile engineering	
	Biochemical engineering and biotechnology	Biochemical engineering and biotechnology	Biochemical engineering and biotechnology
		• Biochemical engineering • Food biotechnology	
	Environmental engineering	Environmental engineering	Environmental engineering
	Metallurgical engineering	Metallurgical engineering	Metallurgical engineering
		Digital process engineering	
			Chemistry

- Development of technologies, materials and products
- Design of processes and facilities
- Running production processes
- Innovations and research
- **Transfer of technologies**
- **Consulting**
- **Educational activities**

- SRPS ISO 9001:2015 Quality management system
- SRPS ISO 14001:2005 Environment protection management system
- SRPS OHSAS 45001:2018 Occupational safety and health management system



CHEMICAL ENGINEERING

The study program of Chemical Engineering is one of the oldest and largest study programs at the Faculty of Technology and Metallurgy, University of Belgrade. The program was derived from the fields of chemical technologies and chemical engineering is one of the pillars of educational and scientific scope of the Faculty's work.

WHAT IS CHEMICAL ENGINEERING?

Chemical Engineering represents the engineering application of fundamental sciences such as chemistry, mathematics and physics to raw material processing with the aim of obtaining desired products. Chemical engineering applies an integrated approach to process design and control from the molecule level, via designing new materials, equipment and processes to industrial facilities. The aim of the work of a chemical engineer is to design facilities for highly-productive, sustainable and clean processes in order to produce a high-quality product with strictly controlled features.

CHEMICAL ENGINEERING AT THE FACULTY OF TECHNOLOGY AND METALLURGY

The Faculty of Technology and Metallurgy has a very long tradition of teaching in the field of Chemical Engineering. Lectures in this field have been organized at the Faculty since 1967. Within the study program of Chemical Engineering, which was introduced in 2008 and modified to a smaller extent in further accreditations, the bachelor and master studies include the following areas:

- Chemical process engineering
- Pharmaceutical engineering
- Organic chemical technology
- Polymer engineering
- Inorganic chemical technology

- Quality control
- Electrochemical engineering

Bachelor and master studies in the study program of Chemical Engineering include a wide range of scientific disciplines and give good foundations for future scientific work, so our engineers can successfully continue their education through doctoral studies at the Faculty of Technology and Metallurgy or other faculties and universities in the country and abroad.

CHEMICAL PROCESS ENGINEERING

The courses studied in Chemical Process Engineering give broad engineering foundations to future graduate engineers. The framework of this elective field includes: process modelling and simulation, process design, equipment design, process dynamics and multi-phase systems. The concept of professional courses is based on the state-of-the-art approach which encompasses the use of modern tools, specialized software design packages, but still based on traditional foundations with introduction of current topics such as process intensification, energy efficiency and sustainable development.

PHARMACEUTICAL ENGINEERING

The elective field of Pharmaceutical engineering is focused on the aspects of chemical engineering relevant to pharmaceutical industry. Students learn about the basic principles of sterile production and specifics of pharmaceutical processes related to pharmaceutical regulations, maintenance of good production practice, product quality control and validation. Through professional courses, students learn about materials, bioactive compounds and industrial enzymes with the greatest application in pharmacy, about biotechnological processes for pharmaceutical production which are conducted with the aid of live cells or enzymes, about basic principles

WHERE ARE GRADUATE ENGINEERS OF TECHNOLOGY – CHEMICAL ENGINEERS EMPLOYED?

The field of employment is quite broad for chemical engineers. Chemical engineers are most frequently employed in industry for running and controlling the production process, in engineering companies dealing with the design of equipment for chemical industry and process facilities, scientific and research institutions, consultant companies as well as in the field of domestic and foreign trade. Some of the industrial sectors employing chemical engineers are basic chemical industry, oil and petrochemical industry, industry of paints and varnishes, pharmaceutical and other industries.

of medication synthesis in pharmaceutical industry, the most important methods and procedures in the production of modern pharmaceutical products. By applying specialized software packages, students are trained for designing processes and equipment used in pharmaceutical industry. Special attention is dedicated to interactive lectures which involve visiting the facilities of pharmaceutical companies, becoming familiar with and resolving specific engineering problems, as well as professional practice in their laboratories, which gives future engineers, an advantage in the labour market.





ORGANIC CHEMICAL TECHNOLOGY

The elective field of Organic chemical technology is focused on the aspects of chemical engineering of interest in all process segments of organic chemical technology such as: oil refining, petrochemistry, organic chemical synthesis and specific-purpose organic chemicals. The concept of professional courses relies on basic transport phenomena and process equipment, e.g. chemical reactors and their design, **catalysis and heterogeneous catalysts, mass and heat transfer phenomena in chemical reactors, influence of catalysts, pressure and temperature on reaction and separation processes in organic chemical technology**, as well as application of supercritical conditions in chemical processes. The teaching process involves the use of specialized software packages for the design, simulation and optimization of chemical reactors and technological processes.

POLYMER ENGINEERING

The instruction in polymer engineering is directed towards production, processing and application of natural and synthetic polymers, polymer materials and composites. Through the courses in this study field, students learn to synthesize, characterize and process polymers and polymer materials which, as appropriate, may be biodegradable, nanofilled, antimicrobial, bioactive, biocompatible, chemo compatible or with other special properties. Great attention is paid to environmental protection, degradation and recycling of polymers and polymer materials, circular economy and sustainable development. Our students are trained to work, in addition to the polymer production and process industry, in the packaging industry, the coating industry (paints and varnishes), pharmaceutical and food industries and other branches, as well as in development and research centres.

INORGANIC CHEMICAL TECHNOLOGY

The instruction within this elective field covers inorganic chemical technology: structure, properties and unit operations in the production of traditional and **modern ceramic materials, glass and glass ceramics**, construction and fireproof materials, bioceramic and nanostructural functional ceramic materials, as well as

theoretical and practical aspects of the drinking and industrial water preparation processes, combustion processes and air pollution problems abatement, technologies for the production of mineral fertilizers, inorganic acids, bases and salts, and process thermodynamics in inorganic chemical technology.

QUALITY CONTROL

Becoming familiar with the principles of technological process control is the main goal of this elective field, and it is studied from the aspect of analytical (chemical) quality control of raw materials, intermediate and finished products by using classical and modern methods of analysis and process control, **which includes monitoring, control and management of technological processes**. Through professional courses, students get acquainted with laboratory **analysis techniques, legal regulations, criteria for laboratory accreditation and standards in the field of quality control and experimental data processing**. Upon completion of the studies, graduate engineers are capable of improving the quality of the production process and the final product as well as the application **and introduction of modern instruments and methods**, which contributes to improving the overall quality of living and working environment.

ELECTROCHEMICAL ENGINEERING

Students of this elective field first learn about theoretical and practical aspects of electrochemistry **and electrochemical engineering, and then through professional courses they study corrosion and corrosion protection methods, including metallic and non-metallic coatings, as well as the design of corrosion protection systems, electrochemical energy sources and various conventional and modern industrial electrolyses**. The study program also includes **colloid chemistry and certain areas of environmental protection**. Upon completion of their studies, students are trained to work in facilities for protection and final processing of metals, production of batteries, **accumulators and similar sources of electricity, for water processing and purification by electrochemical processes, as well as in other industrial electrolyses**.

BIOCHEMICAL ENGINEERING AND BIOTECHNOLOGY

The purpose of Study program Biochemical Engineering and Biotechnology is education of engineers qualified to participate in the implementation and improvement of the existing and the development of new biotechnological processes. Within the study program, knowledge is acquired from **fundamental and engineering sciences, as well as specific scientific disciplines (microbiology, enzymology, biochemistry and genetics)** necessary for understanding bioprocesses and their application in industrial conditions.

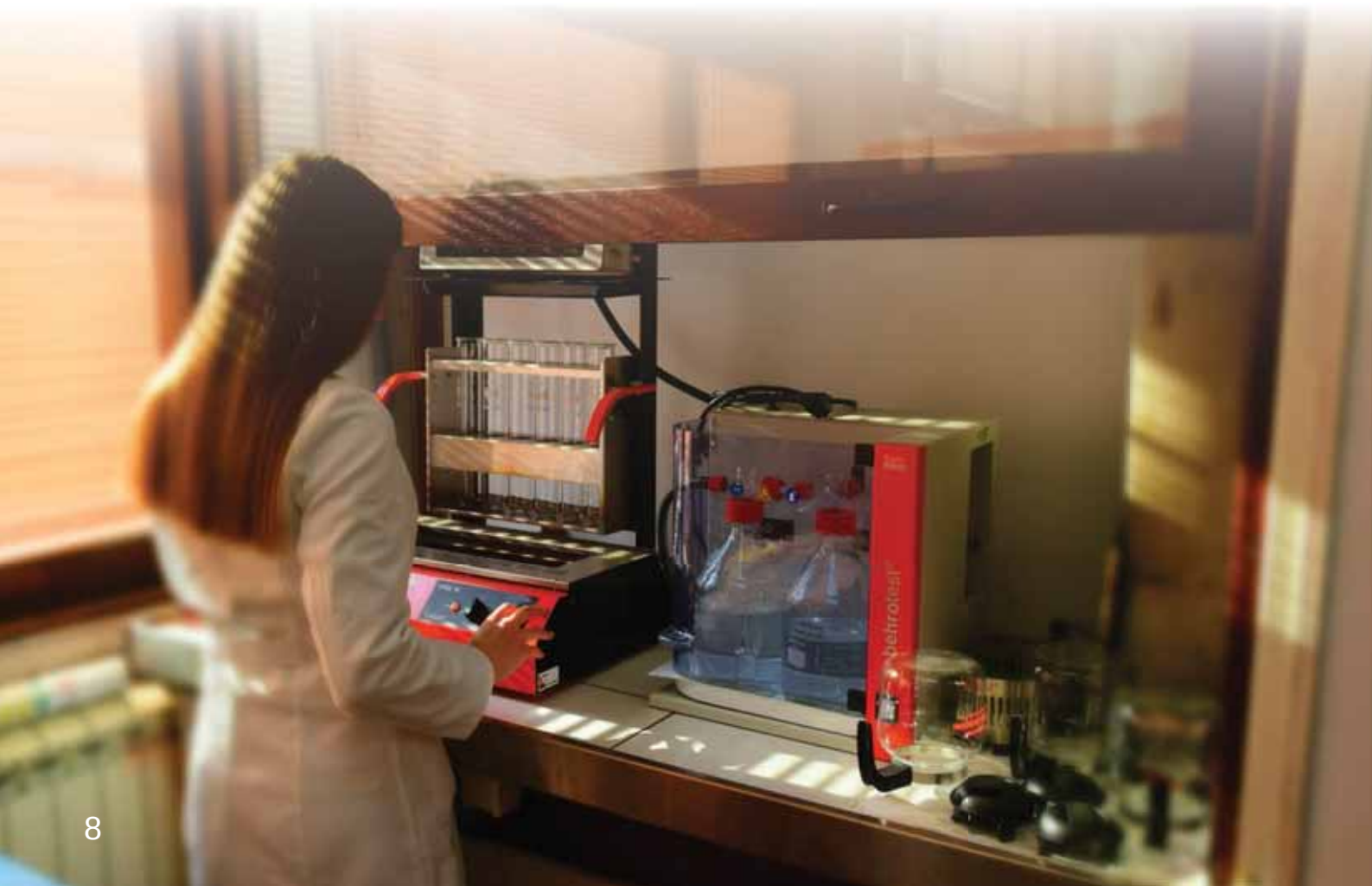
WHAT IS BIOCHEMICAL ENGINEERING AND WHAT ARE BIOTECHNOLOGIES?

Biotechnologies use biological systems (live organisms or parts thereof) for improving the existing or getting completely new products. Biotechnologies are natural and sustainable and they offer solutions to multiple contemporary problems, such as deficiency of energy sources and food or the problem of pollution. They are most frequently based on the application **of microorganisms and enzymes in food and pharmaceutical industries, in waste treatment, as well as in producing organic acids, solvents, amino acids, polysaccharides, biopharmaceuticals, biosurfactants, biofuels etc.** Since it is necessary to provide sterile and other specific conditions for the industrial cultivation of live organisms, the field of Biochemical Engineering

has been developed. It deals with the optimization and modelling of biotechnological processes. Engineers in this field are familiar with biotechnological processes from the laboratory to the industrial level and they are capable of running, controlling, modelling and designing processes. Biotechnological processes frequently use waste substances as raw materials; they are implemented through saving energy and raw materials while biotechnological products are **natural and involved in the natural cycles of the matter.** Biotechnological engineers should be the main participants in the implementation of these processes in line with the modern society trends favouring industrial processes based on the energy saving principles, the use of renewable materials and environmental protection, as well as the concepts of sustainable development and circular economy.

BIOCHEMICAL ENGINEERING AND BIOTECHNOLOGY AT THE FACULTY OF TECHNOLOGY AND METALLURGY

Within the study program of basic academic studies, accredited in 2008 and to a smaller extent modified **in the following accreditations, the introduction of specific contents for this study program begins in the second year, while the number of these subjects increases in the third and fourth years of studies.** The curriculum enables students to acquire necessary knowledge from chemistry and engineering scientific disciplines which are the basis for mastering specific expert subjects of the study program.



WHERE ARE ENGINEERS OF TECHNOLOGY – BIOCHEMICAL ENGINEERING AND BIOTECHNOLOGY – EMPLOYED?

Education in this study program offers the opportunity of finding employment in all fields of biotechnology, food and pharmaceutical industries, in running and designing processes and quality control. Most frequently bioengineers are employed in food industry, pharmaceutical industry, breweries, wineries, alcohol and yeast factories, and in chemical industry, while they are also qualified for working in the educational system, in design and consultant companies. Engineers with the master degree can also continue their schooling within doctoral academic studies in this Department and work on scientific-research projects and in scientific-research organizations.

After the completion of basic academic studies, students can attend one-year master studies. Within the Biochemical Engineering module, the emphasis is on biotechnologies for production of biofuel and fine chemical, as well as production in integrated biotechnological systems based on waste biomass from agriculture and industry. This module also provides students with the opportunity of opting **for adequate elective courses and thus mastering** their knowledge of modern bioanalytical techniques, molecular diagnostics and contemporary methods of development, optimization and application of biosensors. Within the Food Biotechnology module, students study the technology of carbohydrates, fat and oil processing technology, as well as numerous biotechnological processes using enzymes and microorganism for traditional food production, processing and canning, but also for the production of bioactive substances as functional food ingredients.

Basic and master studies in the study program of Biochemical Engineering and Biotechnology include a wide scope of scientific disciplines and give good foundations for scientific work, so our engineers can **successfully continue their schooling in doctoral** studies in the country and abroad in the field of biochemical engineering, enzyme engineering, microbiology, molecular biology, pharmacy, functional food, biofuels etc.



ENVIRONMENTAL ENGINEERING

The Faculty of Technology and Metallurgy, University of Belgrade is the first university and scientific research institution in the field of environmental engineering and one of the carriers of sustainable development in Serbia.

WHAT IS ENVIRONMENTAL ENGINEERING?

Environmental protection implies a series of different procedures and measures that prevent environmental threats, primarily public health, and represents a permanent obligation of all members of the society. Healthy environment is the basis for preserving human existence, sustainable development of the society and the most important condition for quality life.

In 2030 Sustainable Development Agenda, the universal strategy of the United Nations, as many as 10 out of 17 goals refer directly to environmental protection, as one of three aspects, together with economic growth and social policy. Those are: good health and well-being; quality education; clean water and sanitation, affordable and clean energy, industry, innovation and infrastructure; sustainable cities and communities; responsible consumption and production; climate action; life below water and life on land. Therefore, it is clear why environmental protection is the dominant worldwide trend nowadays.

The key contribution to the alleviation and troubleshooting in this field can be provided exclusively by employing a large number of young and educated experts.

Environmental protection is certainly the best example of the necessity for a multidisciplinary approach, where the engineering aspect is very important, i.e. environmental engineering established and developed at the Faculty of Technology and Metallurgy.

ENVIRONMENTAL ENGINEERING AT THE FACULTY OF TECHNOLOGY AND METALLURGY

The Faculty of Technology and Metallurgy has a very long tradition of education in environmental engineering. In 1972 teaching was organized within post-graduate studies and in 1977 within basic studies as well. It was the first time that such teaching was introduced, not only in former Yugoslavia, but also in Southeast Europe. Fifty years of experience in teaching and scientific research work, material and personnel potentials of the professors, associates and **researchers, guarantee the quality of educational, scientific and professional activities.**

In higher years of basic academic studies, in master and doctoral studies, expert courses are studied in the fields of solid and hazardous waste management, recycling, soil pollution and remediation, chemistry,





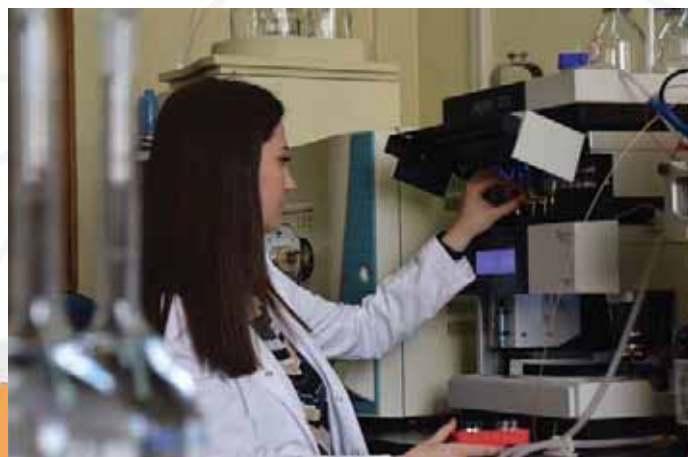
analytics and monitoring of the environment, waste gas treatment, occupational and environmental risk management, bioprocess engineering, water treatment, waste water treatment, process measurement and control, process equipment, renewable energy sources, energy efficiency, circular economy, techno-economic management and consulting, and process design in environmental engineering.

ENVIRONMENTAL ENGINEERING AND SUSTAINABLE DEVELOPMENT

Education and professional training are crucial for the concept of sustainable development, directed **towards the realization of the necessary economic and social development of the society without threatening environment and public health.** Moreover, active cooperation has been established in this field with the faculties and scientific research institutions in the country and abroad.

WHERE ARE GRADUATE ENGINEERS OF TECHNOLOGY – ENVIRONMENTAL ENGINEERS EMPLOYED?

Graduate and master engineers of technology – environmental engineers can find employment in all business organizations dealing with any type of production, from the largest to small enterprises; in consulting companies for development and design of equipment, processes and facilities in environmental engineering; state-run institutions in charge of environment protection at republic, provincial, regional, city and municipal level; institutions and laboratories dealing with water, air and soil pollution control, different inspection services; public utility enterprises (water supply and municipal waste management); recycling centres etc. Today, each of more than one hundred municipalities in Serbia urgently needs several engineers from this field, who would resolve current problems regarding air pollution reduction, water supply, waste water treatment and municipal waste management.



MATERIALS ENGINEERING

The study program of Materials Engineering is mainly aimed at educating engineers who are qualified to view the overall process of selection, production, processing, modification and application of materials and enable to respond to challenges of contemporary high-technology achievements and trends, as well as to cooperate competently with engineers from different fields and with professional teams.

WHAT IS MATERIALS ENGINEERING?

Within this study program, knowledge is acquired in both fundamental (physical and chemical) sciences and in engineering sciences, which enables seeing the connection between the structure of materials (specific features of materials from their basic level – atoms, molecules and supramolecular structures), the manner of processing, macroscopic characteristics of materials and application of materials in real industrial conditions.

After completing basic academic studies, graduate engineers are able to select an appropriate material for certain applications and define the parameters of its obtaining and processing. On the basis of such knowledge of material exploitation conditions, our engineers are able to identify a critical characteristic of material, the structure underlying it, as well as the manner of getting that characteristic in the processing conditions. In that way, graduate engineers are ready to deal successfully with challenges of designing, production, characterization

and application of a wide range of materials and also to consider influences of various parameters of processing on characteristics of a material and its behaviour during exploitation.

MATERIALS ENGINEERING AT THE FACULTY OF TECHNOLOGY AND METALLURGY

Within the study program of Materials Engineering, the second year of basic academic studies enables future engineers in this field to acquire basic knowledge about classes of materials: polymers, ceramics, metals and composites. The third year of basic academic studies provides knowledge from basic engineering courses, as well as research and characterization of materials, while offering the opportunity of choosing more specific orientations and modules:

- **Materials Engineering**
- **Printing Engineering, Design and Packaging**
- **Textile Engineering**

The final semester is common for all students in this study program and provides knowledge from economics and management, packaging materials, processing through printing and recycling of materials.



WHERE ARE GRADUATE ENGINEERS OF MATERIALS ENGINEERING EMPLOYED?

Engineers of Materials Engineering, after completing their studies, have many employment opportunities in all areas of activities such as education, eminent scientific-research institutes, the public sector and companies where they are running the production process, controlling processes control, managing quality control, developing new materials, products and technologies. Engineers with the completed Materials Engineering module can find a job in all processes of the natural material cycle (synthesis/processing, designing and manufacturing of products, selection of materials, recycling and re-use of materials) in many industrial branches, e.g. industry of paints and varnishes, mechanical, vehicle, military, construction and electronic industries and energetics. Engineers who complete the module of Printing Engineering, Design and Packaging can be employed in all companies dealing with any type of printing that are both producers and users of product packaging from their product program. Engineers with the completed module of Textile Engineering can be employed in the sector of fashion industry, specialized textile materials and products, in the area of quality control of textile materials and products, different trade agencies, as well as in all other fields in which textile materials and products are an indispensable component.

Master and doctoral studies deepen the knowledge in fundamental and expert-application areas and students become prepared for scientific-research work by participating in modern topics such as nanotechnologies and nanomaterials, processing and application of materials in biomedicine, dentistry and other biotechnological disciplines, water purification, energy conversion, nanoelectronics etc.



MATERIALS ENGINEERING

Lectures in Materials Engineering is organized by the Department of Organic Chemical Technology – for polymeric materials, the Department of Inorganic Chemical Technology – for ceramic materials, the Department of Metallurgical Engineering – for metals, and the Department for Construction and Special Materials – for composite materials.

Within the ME module, more profound knowledge is acquired about metal, polymeric, ceramic and composite materials. Third- and fourth-year students, depending on their affinities and needs, choose courses which will enable them to acquire specific knowledge from the field of polymers, metals, ceramics and composites. In this manner, they become acquainted in detail with the properties of all classes of materials, as well as with specific functional materials.

In addition, students join student projects organized **with their colleagues from other faculties of the University in Belgrade**, such as: Road Arrow – the first Serbian Formula Student team (design and production of race cars); Beoavia – design and production of drones, Decathlon Twin Box – design and production **of self-sustaining houses, and Engineer Knowledge Team of the Student Parliament of the Faculty of Technology and Metallurgy**. Within these projects, they get prepared for teamwork and application of acquired knowledge in the field of Material Engineering.

PRINTING ENGINEERING, DESIGN AND PACKAGING

Lectures from Printing Engineering at the Faculty of Technology and Metallurgy have been organized in different forms since 1973, with the Department of Printing Engineering as its holder. Since 2021, **within the module of Printing Engineering, Design and Packaging**, first four semesters are dedicated to **the study of the academic-general educational and theoretical-methodological courses**, while from the fifth semester onwards, the focus is shifted to the scientific-professional courses.

The teaching process is a combination of transferring theoretical knowledge and developing practical skills, partly in the laboratories of the Faculty of Technology and Metallurgy (laboratory for pre-press, press and post-press, graphic material laboratory) and partly in the facilities of the renowned companies in Belgrade and its surroundings.

TEXTILE ENGINEERING

The expert segment of lectures in the Textile Engineering module is performed at the Department of Textile Engineering. Since its establishment in 1959, this Department has continuously developed and **modified its teaching and scientific activities according to the development of textile technology in the world and in line with the requirements of the national textile industry**. Nowadays the Department is equipped with modern scientific-research and teaching capacities and with state-of-the-art laboratories.

The curriculum in the Textile Engineering module is harmonized with the European education platform for Textile Engineering students adopted by the European Association of Universities for Textiles (AUTEX). The Department of Textile Engineering has been the full member of the Association since 1998. Education in the Textile Engineering module encompasses research of properties, methods of obtaining, production and application of textile fibres and yarns as initial raw materials in the production of other kinds of textile materials. Apart from that, students are trained to **master fully the technology of conventional textile production with diverse application in clothing**, which is supplemented with the basics of clothes construction and modelling. In addition to conventional textile materials, students also learn about the production of high-performance textile materials (technical textile, geotextile materials, medical textile, sportswear materials, textile for military needs etc.). Substantial part of teaching activities is dedicated to the final processing of textile materials (dyeing, printing and refining) as well as environmental aspects of technologies and quality control.

History of the Faculty

The Lyceum was the first higher-education school in Serbia, opened in October 1838. The lectures from the field of technology were first held in this school in 1853. According to the Law on the Establishment of the Grand School from 1863, the Lyceum was transformed into the Grand School which also included the Technical Faculty. In 1905, the Grand School became the University in Belgrade.



The period between 1905 and 1924 involved the preparation for the establishment of specific teaching for engineers in the field of technology at the Technical Faculty, due to the increasing need for chemical and technological education of future engineers. That period was also marked by the appointment of full professors and introduction of lectures from technological subjects at the former Mechanical-Technical Department of the Technical Faculty. In 1925, the Department for Engineers Technologists was formed at the Technical Faculty. This event is considered the foundation year of the Faculty.



During 1948, the University was reorganized, whereas the Technical Faculty was separated into an independent Technical Higher School, while the Department of Technology became the Faculty of Technology within this school. The name of the Faculty was changed in 1966, when the Faculty's Council decided to change its name into the Faculty of Technology and Metallurgy, which has been kept to date.

Throughout the history of the Faculty, there have been frequent changes in the curricula leading, simultaneously with the development of science and technology, to narrower specializations and education of students in line with the requirements of modern industry.



The latest accreditation of the Faculty of Technology and Metallurgy was obtained in 2021. According to this accreditation, the Faculty has 5 study programs in bachelor academic studies and 6 programs in both master and doctoral studies, which follow the most recent trends in the development of science and technology in their respective spheres.



With its history of almost 100 years of independent existence and 160 years of organized lectures of chemical technology in Serbia, the Faculty of Technology and Metallurgy is the oldest high-education and scientific institution of this profile in the region.



The UNF logo, featuring the letters 'UNF' in a stylized, bold font. The 'U' and 'N' are black, and the 'F' is orange. It is set against a white circular background, which is itself inside a dark blue rounded rectangle.

UNF

1966

1948

1905

1863

1838

METALLURGICAL ENGINEERING

The study program of Metallurgical Engineering was established as the Metallurgy Department of the Faculty in 1948 and ever since it has been the leader of development and education of professionals and scientists in the field of metallurgy, including the improvement of existing and development of new metals and alloys.

WHAT IS METALLURGICAL ENGINEERING?

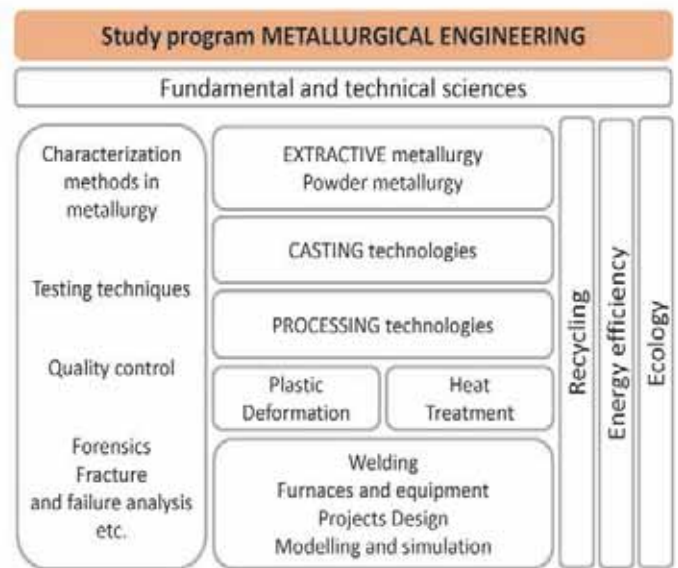
Metallurgical Engineering is a unique study program educating graduate engineers of metallurgy, master engineers of metallurgy and doctors of science in the field of Metallurgical Engineering.

Metallurgical Engineering includes extraction, processing and use of metals with the aim of fulfilling the modern society needs for commercial products of different purposes. Constant innovations, research and upgrading contribute improving of existing and development of new manufacturing technologies and materials meeting all requirements from the aspects of use and profitability, environment protection, energy efficiency, recycling and safety.

Metallurgy is an important field for the development of transport vehicle industry, shipbuilding, airplane industry, mechanical industry, electric power industry, chemical and petrochemical industry, construction, packaging industry, information and communication technologies, as well as for the development of new materials applicable in medicine, dentistry etc. **Therefore, today there is a need for metallurgical engineers or experts with the academic degree and**

knowledge in this field. The knowledge acquired in this study program regarding various technologies of production and processing of metals and alloys, as well as understanding of the relationship between extraction/processing, structure and properties of metal products, enable metallurgical engineers to design new and improve existing materials with upgraded properties and also to optimize the process of manufacturing in order to ensure the production of final products with the required properties by the principles of sustainable development.

METALLURGICAL ENGINEERING AT THE FACULTY OF TECHNOLOGY AND METALLURGY



WHERE ARE METALLURGICAL ENGINEERS EMPLOYED?

Metallurgical engineers can get employment in any company dealing with production and processing of metals and alloys or production of final products with different purposes. **Moreover, metallurgical engineers** are unavoidable members of multidisciplinary teams dealing, for example, with development of new materials, welding, protection of materials, forensics, ecology etc. They can find employment in scientific-research institutes, research and development centres, consultant and project design companies, recycling centres, municipal authorities and inspections, in educational institutions, as well as in organizations for standardization and quality control.



METALLURGICAL ENGINEERING AND MODERN TRENDS

Education and continuous specialization of personnel represent key prerequisites for metallurgical engineers to respond all challenges posed by the forthcoming period. That is why the study program of Metallurgical Engineering pays great attention to acquiring knowledge about new technologies in production and processing of metallic materials in **order to reduce costs, increase energy efficiency and preserve environment and natural resources for future generations**. Ecologically responsible behaviour and recycling have become a professional standard in the field of metallurgy.

Accepting legal limitations in the emission of CO_2 is a huge challenge since coke is the major reducing

agent of oxide ores. It is necessary to master new knowledge and develop new technologies that will use other reducing agents, primarily hydrogen. Another approach to this issue is the development of new light alloys for application in automotive and airplane industries, shipbuilding and railways, thus increasing **energy efficiency and reducing CO_2 emissions**.

Moreover, new challenges and opportunities are expected in the field of additive manufacturing and 3D printing, metal foams, amorphous metals, metals and alloys for electric power sources, computer and mobile phone components etc.

Education in the study program of Metallurgical Engineering will enable metallurgical engineers to take active part in these activities and be ready for changes that are inevitable in the forthcoming period.



Application of light metals and alloys in transport vehicle industry ensures the reduction in fuel consumption and CO_2 emissions into the atmosphere.

DIGITAL PROCESS ENGINEERING

A new study program of graduate academic master studies, Digital Process Engineering (DPE) was introduced due to the requirements of the modern society, economy and process industry, which increasingly use information technologies and advantages offered by digitization. Digital Process Engineering is designed to be attended by engineers of technology from different study programs, as well as other engineering disciplines.

WHAT IS DIGITAL PROCESS ENGINEERING?

In the previous decades, an increasing number of chemical, biochemical, metallurgical and other process engineers used more intensively numerical and optimization methods, programming languages and software applications in their work with the aim of resolving process industry issues at several levels – from devices and units, through processes and facilities to the entire enterprise operations. With time, these activities, both in the field of research and in the engineering practice, formed a separate sub-area of chemical and process engineering – Process System Engineering. Today, this field is more frequently studied as a separate program at the master level at universities worldwide, taking into account the specific features of integral and interdisciplinary approach, and the requirements of the society and economy (Industry 4.0 etc.). In the past few years, this field has rapidly developed towards the use of artificial intelligence and big data manipulation for the requirements of process industries. Because of the introduction of new directions of development, this study program is called Digital Process Engineering, the name and curriculum which has been pioneered by the Faculty.

By using the knowledge acquired in the bachelor academic studies at the Faculty of Technology and Metallurgy or other engineering schools, while also acquiring new knowledge and skills from information technologies in the DPE program, future engineers will be able to contribute to the resolution of great challenges to the society and environment (climate change, exhaustion of natural resources, excessive pollution of the environment, pressure on biodiversity, huge consumption of products etc.) and to participate in transition towards sustainable

development and circular economy, as the basic goals of the Faculty of Technology and Metallurgy.

WHERE ARE MASTER ENGINEERS OF TECHNOLOGY – ENGINEERS FOR DIGITAL PROCESS SYSTEMS – EMPLOYED?

Chemical, petrochemical, pharmaceutical, metallurgical and food industries and environmental protection are industries that most commonly employ engineers educated at the Faculty of Technology and Metallurgy, including those from DPE program. The program offers students, after the completion of their studies, the opportunities to run digitization processes in business and industrial environments and to cooperate more efficiently with software engineers and multidisciplinary teams. In addition, the study program offers the theoretical and practical basis to graduate students in their further training and orientation, both in smaller innovative enterprises (tech start-ups). In such environments, engineers with completed DPE will be able to conceive digital systems and software, and particularly their business logic (and architecture), and to give them a domain context, as well as the content to data bases in the field of technology, while understanding the basics of information technologies, algorithms and numerical methods.

DIGITAL PROCESS ENGINEERING AT THE FACULTY OF TECHNOLOGY AND METALLURGY

Master academic studies are designed as the continuation of education after basic academic studies, primarily for students from the study program Chemical Engineering, but also from other technological and engineering programs. DPE master study program is aimed at educating engineers of technology for performing jobs of digital designing and operating process facilities, process optimization and simulation, energy and material process integration, process intensification, the use of intelligent systems etc. In addition, they will be able to direct themselves towards managing jobs, both in the process and product development and in enterprise operations: optimization of supply chains and flow of materials, resource management, and even in marketing, through the use of digital technologies and software.

The program predominantly covers practical instruction and students' independent work at computers through the use of modern programming languages (e.g. Python), the library of numerical methods, as well as specialized software packages. The professional practice is organized in digital and development departments of process industry companies and also in ICT companies and innovative firms.

CHEMISTRY

The study program Chemistry at the Faculty of Technology and Metallurgy is available only in doctoral academic studies. It was first accredited in 2008. It is aimed at educating doctors of science who are qualified for independent research work in different fields of chemistry, for team work and running teams and the application of acquired knowledge in problem-solving in practice wherever chemistry is applied, from academic institutions to developmental laboratories in industry.

WHAT IS CHEMISTRY?

As a natural science, chemistry basically involves the study of chemical elements and compounds, their structures and properties, chemical reactions and **their mechanisms, as well as the laws that unite all of the above through inorganic chemistry, organic chemistry, analytical chemistry, physical chemistry and electrochemistry.** This fundamental knowledge **is extended in the doctoral academic studies at the Faculty of Technology and Metallurgy** by building on the engineering knowledge acquired during the bachelor and master studies. Chemistry applies the multidisciplinary approach in researching the development of new organic and inorganic products, **nano and micro materials, analytical methods for testing and quality control, production of electricity and heat, etc.**

WHERE ARE EXPERTS WITH PhD IN CHEMICAL SCIENCES EMPLOYED?

The PhD degree in Chemical Sciences, acquired **through the defence of the doctoral dissertation,** ensures employment in the academic community and different branches of economy and it is recognized as equal to degrees from the European academic institutions. These PhD experts are qualified for taking the leading role in the improvement of science and practical application of scientific achievements in all fields of chemistry. The acquired knowledge and skills may be applied in the development of new materials, modern technologies of producing different organic and inorganic substances, in energy production, primarily by ecologically acceptable procedures, then in environmental protection, as well as the development of new **methods of quality control of different products.**

CHEMISTRY AT THE FACULTY OF TECHNOLOGY AND METALLURGY

The study program Chemistry enables students with the focus on engineering sciences at previous levels of study to supplement and improve their fundamental knowledge of chemistry. All courses are elective, so that **students, in agreement with the mentor, can choose** the ones that will best prepare them for research work within the doctoral dissertation. Students are offered a wide range of areas in which they can do their doctoral dissertations. Those are primarily **inorganic chemistry, organic chemistry, analytical chemistry, physical chemistry and electrochemistry,** as areas with a long tradition of scientific work at the Faculty of Technology and Metallurgy. In doctoral studies, these areas are covered through a number of **narrower areas such as synthesis, structure, reactivity and functionality of organic, inorganic and polymeric compounds, chemical kinetics, chemical thermodynamics, biochemistry, catalysis, solid state chemistry, crystallography, electrochemical energy sources, pollutant analysis, analytical methods, etc.** In their work, students have the wholehearted help of mentors and other professors and use the entire modern equipment the Faculty has at its disposal. Within various forms of cooperation, it is possible to connect and work together with related laboratories in the country and abroad and to participate in national and international scientific conferences. Depending on the requirements of the departments, doctoral students are engaged in working with undergraduate and master students, which enables the acquisition of valuable experience in the transfer of knowledge for those who plan an academic career.



SCIENTIFIC RESEARCH

The Faculty of Technology and Metallurgy is the leading scientific and research organization in the fields traditionally pursued at the Faculty, such as **chemical engineering, materials engineering, metallurgy, biotechnology, biochemical engineering, environmental engineering and textile engineering.** The Faculty constantly advances research opening new fields within the existing general topics, as well as taking a multidisciplinary approach in the development of new technologies, processes and materials.

In the last five years, staff at the Faculty of Technology and Metallurgy and the Innovation Centre of the Faculty published over 1,000 papers in journals included in the SCI list. About 45% of these papers were published in international Q1 and Q2 journals.

The research at the Faculty of Technology and Metallurgy is in the line with goals and methods established in the Strategy of Scientific and Technological Development of the Republic of Serbia – Research for Innovations, as well as in the Strategy of Smart Specialization in the Republic of Serbia for the period 2020-2027, with the defined priority fields, including ***Food for Future, Creative Industries and Machines and Production Processes of Future,*** as well as for the supporting fields, some of which are ***Energy Efficient and Eco-Smart Solutions, Eco-Smart Energy Sources, Advanced Materials, Advanced Production Technologies and Electronics, and Biotechnology.***

To achieve these goals, scientific and research work has been organized and realized simultaneously in several segments:

- Work on projects in different programs of the Science Fund, Ministry of Education, Science and Technological Development of the Republic of Serbia, and of other national Ministries.
- Creation and implementation of projects funded by the Innovation Fund of the Republic of Serbia. In this segment, the Faculty participates in the Collaborative Grant Scheme Program, Technology Transfer Program, Innovation Vouchers, Innovation Co-Financing, Proof of Concept and other relevant calls.
- Work on international projects. The Faculty intensively works on the realization of existing and preparation of new projects supported by international funding: Horizon 2020, Horizon Europe, UNIDO, SIDA, DFG, GIZ etc.



COOPERATION WITH INDUSTRY

Ever since its establishment, the Faculty of Technology and Metallurgy at the University of Belgrade cooperates extensively with national and international business communities in the fields of chemical engineering, biotechnology and biochemical engineering, environmental engineering, materials engineering and metallurgy.

The Faculty's teaching and research staff puts significant efforts to establish new and maintain existing cooperation with the Serbian industry and large foreign companies operating in Serbia to improve and further develop existing products **and technologies, as well as to design, transfer** and establish new products and technologies.

Apart from consultancy services in the area of applied research, the Faculty has participated for many decades in preparing a large number of projects, elaborations, studies, action plans and other relevant documents.

With the aim of developing more efficient cooperation with industry, the Faculty has established the following centres:

- Innovation Centre of the Faculty of Technology and Metallurgy in Belgrade was **founded with the aim to create innovations**, develop prototypes, new products and services as well as to transfer knowledge and technologies developed at the Faculty to industrial utilization.
- **Cleaner Production Centre**, with the support of UNIDO, was founded to promote and realize the concept of cleaner production in companies in Serbia and to raise awareness about the importance of sustainable development.
- R&D Centre for Graphic Engineering of the Faculty (RIC) was established in order to provide services related to the printing process, i.e. to offer services in preparation, printing and finishing graphics products.
- Centre for Pulp, Paper, Packaging and Graphics (CPA&G) was established to enable cooperation with companies in the field of production of paper, packaging and graphic industry.



INNOVATION CENTRE OF THE FACULTY OF TECHNOLOGY AND METALLURGY

The Innovation Centre of the Faculty of Technology and Metallurgy in Belgrade Ltd. was established on 24th June 2009 by the decision of the Faculty's Council, with the aim of transferring knowledge and technologies from scientific-research institutions to industry. It employs more than 100 researchers, half of whom hold a PhD degree.

The mission of the Innovation Centre is to establish **a national research and innovation system integrated** in the European and world research space, relying on partnerships in the country and abroad, as well as contributing to the social, cultural and scientific progress, while its primary aim is to create innovations, develop prototypes, new products and services and, at the same time, to transfer the knowledge and **technologies into industry, which will result in rational** and sustainable development of economy in Serbia and the region.

The vision of the Innovation Centre is excellence and relevance in science, achievement of highly influential results of innovative activities, economic development and competitive economy in Serbia, as well as the development of the society as a whole. Basic directions of the development are: synthesis of new functional materials and their innovative application, usage of nanosciences and nanotechnologies, the development of clean and energy efficient technologies, in line with the concept of circular economy and sustainable development.

The Innovation Centre of the Faculty of Technology and Metallurgy performs activities in the field of research, experimental and innovation projects in technical, **technological and other natural sciences, thus** contributing to the creation of new products, modern technologies, processes and services. For its strategic direction, the Innovation Centre has established and documented, while applying and constantly improving the Integrated Management System.

It implements the policy based on modern, socially justified and market-oriented principles, with the aim of fulfilling the requirements, needs and expectations of users in the field of innovative activities, i.e. research and development in natural, technical and technological sciences. The Centre applies Integrated Management System according to the international standards ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018.

Since the establishment of the Innovation Centre, **its researchers have authored or co-authored more** than 1,000 papers published in scientific journals of international importance, participated in the preparation and publication of more than 160 technical solutions and 35 patents, while also publishing papers **in nationally relevant journals as authors or co-authors** of more than 180 papers. In addition, the researchers employed in the Innovation Centre have participated in more than 40 innovative projects, 17 COST actions, 12 EUREKA projects, 30 bilateral projects, 25 international projects and several dozens of projects within the cooperation with economy in domestic and international markets.

The Innovation Centre of the Faculty of Technology and Metallurgy, **as an innovation institution with** a large number of researchers and ten-year long tradition and experience in research and development of new technologies in the sphere of chemical, biochemical and material engineering, metallurgy and environmental protection, establishes a short-term and long-term strategy of attracting capital investments and cooperating with the economic sector in these fields of science and research. The essence of its strategy is reflected in the identification of competitive advantages of the Innovation Centre as a research community, the analysis of supply and demand, i.e. real market requirements, the analysis of target groups in economic and industrial spheres, the identification of existing and potential investment opportunities, as well as implementation, monitoring, **evaluation and adjustment of the strategy to the actual** state in the market.



Cleaner production is an overall prevention strategy of environmental protection which is applied to processes, products and services with the aim of reducing their negative impact on people and environment. In order **to achieve adequate results, it is necessary to have** the cooperation of all interested parties: local self-government, industry and population.

The Cleaner Production Centre of Serbia was founded in 2007 at the Faculty of Technology and Metallurgy of the University of Belgrade with the support of UNIDO (UN Industrial Development Organization) and its own activity is the promotion and introduction of cleaner production in Serbia.

So far, more than 150 companies, including the pilot-project from 2006, have taken part in the program Cleaner Production and more than 70 national experts have been trained. The companies participating in the projects of introducing cleaner production differ in size and activities.

In the period 2015–2017, the Cleaner Production **Centre at the Faculty of Technology and Metallurgy** of the University in Belgrade completed the project „Implementation of the IPPC/IE Directive in the Intensive Rearing of Poultry and Pigs“. The project was conducted in cooperation with the Ministry of **Agriculture and Environmental Protection of the Republic of Serbia**, and was financially supported by the Swedish International Development Cooperation Agency. The general aim of the project was providing support to the relevant bodies in Serbia and the operators in the process of adopting a sustainable approach to the implementation of the IPPC/IE Directive in the facilities for intensive rearing of poultry and pigs, taking into consideration its relations with other directives and specific features of the relevant facilities.

Between 2018 and 2021, the project IED Serbia supported our country in the implementation of the Directive on Industrial Emissions, both at the **institutional level and at the level of individual companies**, assisting Serbia in its European Union accession process. The project was conducted by the **Cleaner Production Centre at the Faculty of Technology and Metallurgy**, with the funds in the amount of 1.46 million EUR provided by Sweden.

Since 2019, the Cleaner Production Centre has coordinated the work on GEF-SAICM project „Global Best Practices on Emerging Issues under SAICM“. The Serbian centre has provided leadership in **reformulating dyes which still contain lead, through** technical support to the Centres, the members of the global RECP Net from Peru, Ecuador, Colombia, Indonesia, Jordan and China. Within its activities, the Centre will prepare a manual for small and medium enterprises and organize practical training in the countries participating in the project. The Ministry of Environmental Protection of the Republic of Serbia is the member of the Project Steering Committee.

Between 2018 and 2020, the Centre worked on UNIDO-GEF project “Development of Guidelines and Documentation for the Green Chemistry Technology Case Studies”, in cooperation with Yale University, the USA. During the 3-year period, the project provided the building of capacities and training on the principles and technologies of green chemistry for national experts from industry, national centres for cleaner production, scientists and the academic community, as well as conducted pilot demonstrations of applicable uses and technologies of green chemistry at the level of facilities for certain developing countries and transition economies.

Project eVOC refers to the identification and reduction of emissions from the operators which use volatile organic compounds (VOC) in their processes. The general goal of the project is to support the Ministry of **Environmental Protection and the Environmental Protection Agency of the Republic of Serbia** in transposing Chapter V of the Directive on Industrial **Emissions in the national legislation, as well as to** support primarily small and medium enterprises which use volatile organic compounds in their production processes in fulfilling the requirements of the Directive. The project is financed by the Embassy of the Kingdom of Norway to Belgrade. The project lasts for 4 years, from 1st December 2018 to 30th November 2022.

Globally speaking, our Centre is part of the Network for Resource Efficient and Cleaner Production (RECP Net) which is jointly supported by UNIDO and UNEP.



RESEARCH AND DEVELOPMENT CENTRE OF PRINTING ENGINEERING AT THE FACULTY OF TECHNOLOGY AND METALLURGY

The Research and Development Centre (RIC) of Printing Engineering was established in 2006 by expanding the basic activity of the existing Graphics Institute of the Department of Printing Engineering.

The Research and Development Centre of Printing Engineering is an organizational unit of the Faculty of Technology and Metallurgy that constitutes the basis for conducting practical instruction for students of the module Printing Engineering, Design and Packaging from the study program Material Engineering. The Centre also deals with service activities related to the printing process, i.e. offers services of pre-press, printing and finishing the graphic products. The Centre offers printing services primarily to the Faculty with textbook material and other materials necessary for lectures, as well as all printing products necessary for the work and promotion of the Faculty. Free capacities are in the function of providing printing services to other publishers or third persons. The Centre is the only organization for providing printing services within the University of Belgrade and has an integrated quality system for providing printing services (ISO).

Through the planned concept of work process modernization, apart from the existing offset machines, some new equipment has been acquired, thus enabling the application of various technologies of printing (traditional offset printing, colour and black and white digital printing, plotting, disc printing) in making graphics products.

These printing technologies enable printing of small print-run publications or smaller books with a bigger print run in a short period of time, the production of posters and banners, as well as printing covers for all sorts of binding, making trial imprints, printing of promotional materials (leaflets, catalogues, flyers, brochures, business cards), invitation cards and various personalized materials: acknowledgements, certificates, charters, diplomas etc.

For the purpose of promoting publications of the Faculty of Technology and Metallurgy, we have also made and we maintain the website for online sale of books. In this manner, the broader audience is enabled to see and purchase the entire printed material of the Faculty.

In the procedure of ISO standard introduction, a survey was conducted with the aim of checking customer satisfaction with the Centre services. The Centre received the highest marks in the survey.



CENTRE FOR PULP, PAPER, PACKAGING AND GRAPHICS

The Centre for Pulp, Paper, Packaging and Graphics (CPA&G) was established in 1994 as a scientific-professional unit within the **Faculty of Technology and Metallurgy** of the University in Belgrade, with the aim of gathering interested companies and experts from the relevant industrial branches.

Centre CPA&G members are all factories of paper and cardboard from Serbia, North Macedonia, Montenegro and Bosnia and Herzegovina, as well as some companies from Slovenia, Croatia, Austria, Germany, Finland, Slovakia, Czech Republic and the USA producing, apart from paper, accompanying equipment, raw materials and accessories, as well as dealing with research in the field of energy and energy conservation, environmental protection and automatic control.

The main goals of the Centre CPA&G are:

- Including all factories in the relevant branch of industry in this scientific-professional institution through their membership;
- Joint work on professional and scientific training, and development and improvement of technology in each of its members;
- Alignment of development programs at the state and regional levels, research in the field of raw materials, energy and ecology;
- Establishing a central laboratory at the Faculty of Technology and Metallurgy and laboratories in some of the factories;

- Preparation of projects, elaborations and expertise at the state level and for some factories;
- Connecting scientific institutes, chambers of **commerce and relevant ministries with economy** for the purpose of improving the economic ambience for more successful business operations;
- Education and training of the personnel with appropriate profiles for this industry;
- Organizing symposiums, conferences and seminars;
- Connecting with international scientific institutions and working on research projects;
- Providing foreign expert literature for this branch of industry.

In cooperation with the Chambers of Commerce of Belgrade and Serbia and relevant Ministries of the Government of the Republic of Serbia, Centre CPA&G makes projects, elaborations, expertise and feasibility studies in this field and in the energy conservation field, trying to be the link between economy and state institutions.

To date, the Centre has organized 23 national and international CPA&G symposiums and published the accompanying collections of complete works, as well as several thematic editions of professional journals, studies and scientific-professional books.

In the past twenty years, the activities of the Centre CPA&G turned into the regional centre of this branch of industry that is relied on, except for Serbia, by Montenegro, Bosnia and Herzegovina and North Macedonia.

CENTRE FOR NANOTECHNOLOGIES AND FUNCTIONAL MATERIALS

The Centre was established in 2010 aiming to increase quality, capacity and potential of research, and to **integrate the Faculty of Technology and Metallurgy** into the European research space. It consists of several research groups: inorganic materials, polymer materials, composite materials, electrotechnical material production and tissue engineering.

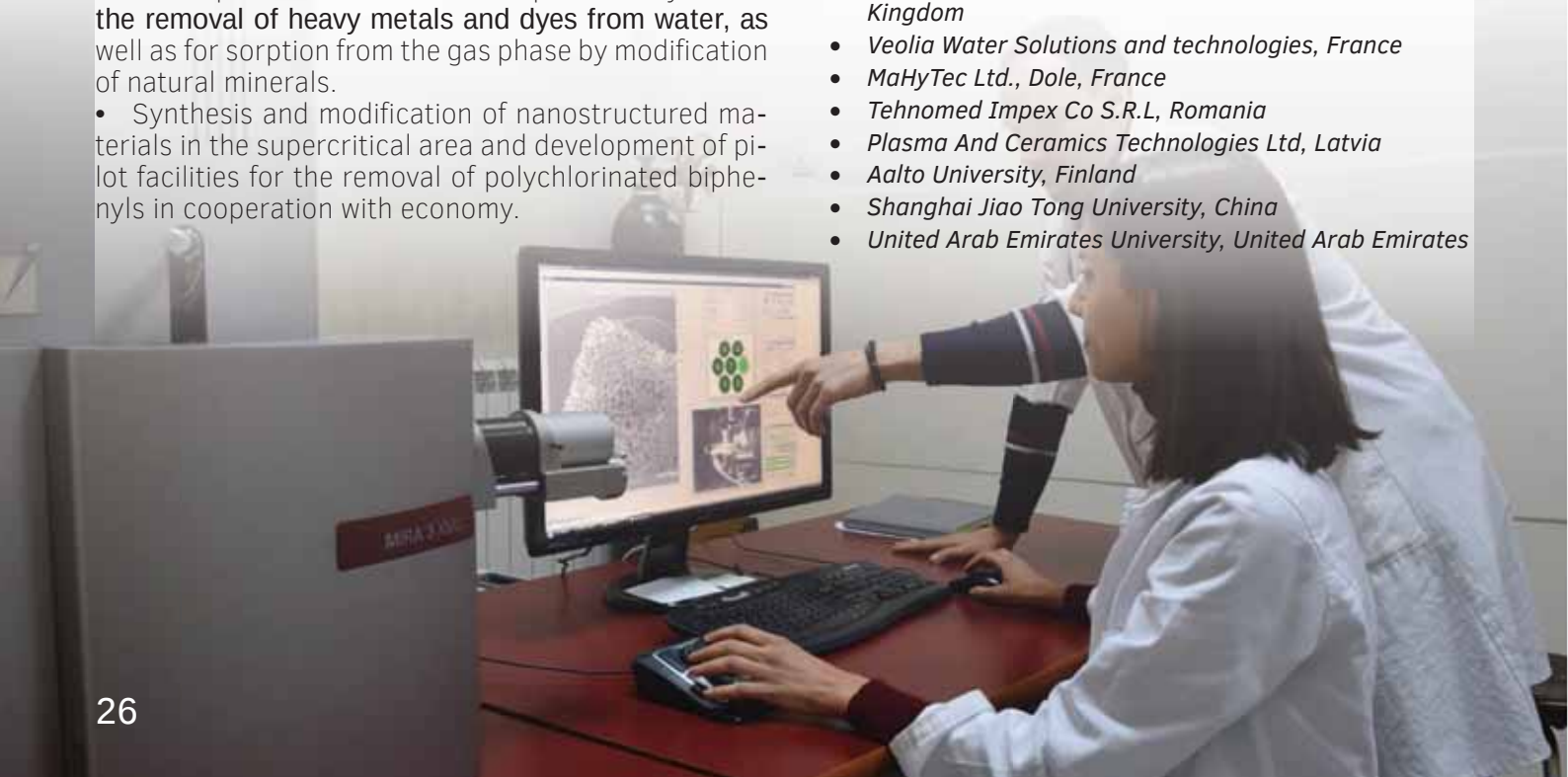
The Centre studies synthesis, processes and development of technologies for producing modern **nano-structural multifunctional materials** with advanced features, of high purity and homogeneity, processed in the form of powders, nanofibers, porous or dense compacts, nanocomposites and coatings, as well as investigates the possibility of their application in biomedicine, dentistry, pharmacy and biotechnology, environmental protection, photocatalysis, photovoltaic systems and others.

Current research conducted within the Centre:

- Fabrication of nanostructural materials with adequate biomechanical properties by applying different methods based on hydroxyapatite, bioglass, biopolymers, graphene, and their combination, with the incorporation of therapeutical ions, medications and extracellular vesicles, for the application in the regeneration and reparation of bone, dental and soft tissues.
- Testing anti-tumour medicines in the flow bioreactor on biomimetic carriers with immobilized cells.
- Biotechnological procedures of producing plant extracts, encapsulation of probiotic cultures, as well as production of biodegradable drug carriers for the application in the pharmaceutical industry.
- Synthesis of organometal halide perovskites for the purpose of constructing photodiodes or solar cells.
- Production of nanofibers with carbon structures and their modification with transition metal oxides in the form of spinels.
- Development of sorbents and photocatalysts for **the removal of heavy metals and dyes from water**, as well as for sorption from the gas phase by modification of natural minerals.
- Synthesis and modification of nanostructured materials in the supercritical area and development of pilot facilities for the removal of polychlorinated biphenyls in cooperation with economy.

The Centre for Nanotechnologies and Functional Materials has 18 members, as well as 10 PhD holders and **13 PhD students who are doing their research within it**. The Centre also ensures the preparation of doctoral **dissertations, as well as the training of researches** in foreign institutions. Through international projects, the Centre researchers cooperate with their colleagues from the following foreign institutions:

- *European Centre for Nanostructured Polymers ECNP, Italy*
- *CNRS Institut de Physique et de Chimie de Strasbourg, France*
- *University of Agriculture, Athens, Greece*
- *National Institute for Lasers, Plasma and Radiation Physics, Romania*
- *Riga Technical University/Institute of Inorganic Chemistry, Latvia*
- *Laboratoire de Mécanique Appliquée R Chaléat, University of Franche Comte, France*
- *University College London, United Kingdom*
- *The Hong Kong Polytechnic University, Hong Kong, China*
- *Institut für Physikalische Chemie der Universität Göttingen, Germany*
- *Delphi - Advanced Diesel Engineering, United Kingdom*
- *Institute of Optoelectronics, Military University of Technology, Poland*
- *Institute of Biochemistry Romanian Academy, Romania*
- *Bulgarian Academy of Sciences / Institute of Solid State Physics, Bulgaria*
- *Institut De Chimie Des Surfaces Et Interfaces – Cnrs, France*
- *Lab. Du Genie De La Conception Equipe D'Ingenierie Des Surfaces De Strasbourg, France*
- *University of Birmingham, School of Dentistry, United Kingdom*
- *National Technical University of Athens, Greece*
- *ELKEDE Technology and Design Centre, Greece*
- *Procter & Gamble-Technical Centres Ltd, United Kingdom*
- *Veolia Water Solutions and technologies, France*
- *MaHyTec Ltd., Dole, France*
- *Tehnomed Impex Co S.R.L, Romania*
- *Plasma And Ceramics Technologies Ltd, Latvia*
- *Aalto University, Finland*
- *Shanghai Jiao Tong University, China*
- *United Arab Emirates University, United Arab Emirates*



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