



Erasmus+ CBHE Project

Creating the Network of Knowledge Labs for  
Sustainable and Resilient Environments - KLABS

# STUDY PROGRAMMES



Co-funded by the  
Erasmus+ Programme  
of the European Union

## DISCLAIMER

*The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.*

## BACKGROUND

The project **Creating the Network of Knowledge Labs for Sustainable and Resilient Environments – KLABS** (561675-EPP-1-2015-1-XK-EPPKA2-CBHE-JP) is a joint capacity building action in the field of higher education, co-funded by the Erasmus+ Programme of the European Union.

KLABS is a pioneering educational platform that addresses two current and equally important challenges of urban and rural built environments in Western Balkans – sustainability and resilience to climate change. Project Consortium is composed of five higher education institutions from the European Union (University of Ljubljana, University of Strathclyde, Università Iuav di Venezia, Technische Universiteit Delft, and Rheinisch-Westfälische Technische Hochschule Aachen) and six higher education institutions from the Western Balkans region (University of Banja Luka, State University of Novi Pazar, "Džemal Bijedić" University of Mostar, University in Kosovska Mitrovica – project coordinator, University of Belgrade and Higher Technical Professional School in Zvečan). Within the 3-year period of project life (15.10.2015-14.10.2018), KLABS teams produced various results with the common aim to catalyse the generation of innovative, interdisciplinary and specialized knowledge, by joining the areas of Engineering, Architecture, Construction and Environmental Protection.

## REPORT CONTENTS

This document presents second-cycle programmes at six Western Balkans higher education institutions, developed or modernised in the framework of the Erasmus+ project KLABS, as follows:

ARCHITECTURE AND URBANISM.....	3
ENERGY EFFICIENCY OF SETTLEMENTS.....	9
ENVIRONMENTAL INFRASTRUCTURE MANAGEMENT.....	13
SUSTAINABILITY AND RESILIENCE OF THE BUILT ENVIRONMENT.....	19
ENERGY EFFICIENT AND GREEN ARCHITECTURE.....	27
FIRE PROTECTION.....	35



# ARCHITECTURE AND URBANISM

## Academic Master Programme

University of Banja Luka – Faculty of Architecture, Civil Engineering  
and Geodesy

Second cycle study programme “Architecture and Urbanism” at the University of Banja Luka – Faculty of Architecture, Civil Engineering and Geodesy was developed within the EU’s Erasmus+ capacity building project in the field of higher education entitled “Creating the Network of Knowledge Labs for Sustainable and Resilient Environments” (KLABS).

Sustainability and resilience of the built environment are becoming important topics in the Western Balkan countries. The importance is reflected, mainly, through the efforts of harmonization of national legal frameworks with the European Union framework. Education sector follows these trends to a very limited degree. Academic programmes dealing with the topic of sustainability are scarce in the Western Balkan countries and mainly focused on energy efficiency aspects. Specialized programmes that imply comprehensive education about the sustainability and resilience of the built environment in the Balkan region do not exist. The lack of adequate knowledge, visible in significant and lasting environmental damage, affects the increase of ecological, social and economic risks, but also poses an aggravating factor in the European area of education and labour market.

Master Programme “Architecture and Urbanism” is dedicated to the reaffirmation of the Architect/Urbanist profession in the Western Balkan countries, in the context of contemporary society challenges that are reflected in dynamic spatial and climate changes. The main characteristics of the urban and built environment today are constant change and complexity. Urban problems require comprehensive and interdisciplinary approach to thinking, designing and planning the urban and built environment, and the new generation of professionals capable of dealing with the stated challenges of contemporary society. Therefore, the focus of curriculum is on sustainability and resilience concepts in the national and local context of designing and thinking buildings, cities, landscapes and territories. In addition, programme “Architecture and Urbanism” places these concepts on operational level and introduces a wide range of techniques and tools that are necessary for assessing and analysing the built environment and its processes in a range of spatial scales.

Emphasizing a trans-disciplinary and trans-scalar design-oriented approach, study programme equips students with the theoretical and methodological knowledge that will allow them to think, analyse and design the built environment in **a comprehensive manner**. This means understanding of relation between different spatial scales, social processes and natural context, as a precondition of sustainability and resilience. The aim of programme is to deliver professionals who will understand the importance of **an integrated approach** to planning and design and are able to cooperate with professionals from a range of disciplines of the built environment, citizens and other actors. In addition, the aim is to deliver **socially responsible professionals** who are committed to cultural sustainability and social relevance of spatial design over desire to produce high quality aesthetic.

The academic title acquired after the completion of the study program is **Master of Architecture and Urbanism - 300 ECTS**.

## Curriculum

Programme “Architecture and Urbanism” provides **one-year curriculum** in the research and analysis of the built environment at different scales aimed at identifying integrated architectural and urban solutions in the context of sustainability and resilience.

Programme is organized in two semesters. While the first semester integrates theoretical, analytical and design explorations, the second is entirely devoted to the development of master thesis. Students get awarded with 60 ECTS credit-points made up of 12 ECTS for basic theoretical courses, 18 ECTS for approved elective disciplinary courses, 10 ECTS for methodological course, and 20 ECTS credits for master thesis. Students are encouraged to use curriculum to develop their theoretical knowledge and analytical skills and deploy these in pursuit of their own research interests.

The first two basic theoretical courses (6+6 ECTS) provide students with in-depth theoretical knowledge about principles of sustainability and resilience, their historical perspectives and connectivity, with special focus on relation of different urban scales and global-local dichotomy.

The second block, consisted of two elective disciplinary courses (9+9 ECTS), provides students with the knowledge of methods, techniques and tools for contemporary analysis and assessment of urban environment at integrated scales. Elective courses are divided into two groups and students can choose one course from every group. The first group of elective courses is about design methodologies and techniques for urban transformation of four distinctive urban layers: infrastructure systems, water landscapes, green structures and built environment. The second group encompasses generally applicable methodologies and tools for urban transformation: analytical design tools, parametric design tools, urban regeneration methodology. Each course is organized as a studio design project of real-life cases by application of the gained knowledge of methods, techniques and tools offered to students.

The third block (5 weeks) in second semester has one methodological course (10 ECTS) that provides students with the knowledge of methods for comprehensive research on specific subject and development of related design solution, as well as with more traditional

modes of academic research. During this course the students define their final thesis problem and thesis structure which will be presented at the end of the course and approved by corresponding department.

The fourth and final block (10 weeks) is intended for master thesis development and finalization (20 ECTS). Master thesis provides students with an opportunity to conduct comprehensive research of specific subject/problem and to develop related design solution. They are encouraged to choose the subject/problem of their own interest at the programme's very beginning.

## COURSE LIST

### PROGRAMME ARCHITECTURE AND URBANISM

#### SEMESTER 1

30 ECTS

1	Concepts and Principles of Sustainability and Resilience in the Built Environment 6 ECTS
2	Urbanisation in Western Balkan Countries 6 ECTS
3	Elective Course I 9 ECTS
4	Elective Course II 9 ECTS

Electives Group I	Sustainability and Resilience of Infrastructural systems 9 ECTS
	Water Space and Landscape Design 9 ECTS
	Green Space and Landscape Design 9 ECTS
	Architecture of City and Landscape 9 ECTS

Electives Group II	Analytical Urban Design 9 ECTS
	Parametric Design 9 ECTS
	Regenerative Design 9 ECTS
	Virtual Mobility Window 9 ECTS

#### SEMESTER 2

30 ECTS

1	Urban Research Methodology 10 ECTS
2	Master Thesis 20 ECTS

#### Learning methods, IT and e-learning

Master programme "Architecture and Urbanism" combines a range of teaching and learning techniques, including field work, essay writing, seminar debating, with a focus on an elective studio design project at the end of the first semester. The final master thesis provides students with an opportunity to conduct comprehensive research into a specific subject and develop the related design solution.

Programme foresees utilisation of software for parametric urban and architectural design, as well as of on-line connectivity software and equipment for organisation or attendance to the

virtual lectures of guest lecturers from other higher education institutions in the country and abroad, that is, the lecturers from commerce and other sectors. Programme also implies the use of an existing electronic platform at the Faculty of Architecture, Civil Engineering and Geodesy, that will serve to accommodate teaching and learning materials, and is available to teachers, associates and students. The collection of published material developed within the project KLABS according to the programme content and needs – [Reviews of Sustainability and Resilience of the Built Environment for Education, Research and Design \(TU Delft Open, 2018\)](#) – is available to students in electronic format via open access.

### **Flexible learning paths**

“Architecture and Urbanism” programme implements the "learner-centred approach" through the definition of flexible learning paths that are based on learning outcomes and provided through elective courses. Students are given a possibility to select topics according to their own interests and plans for future career development. The percentage of elective courses at the study program is 60.00%.

### **Integration of research with education**

Students work with University and Faculty professors and associates who are actively involved in academic and applied research, as well as (through consultancy) with WB practitioners from a range of disciplines dealing with the built environment, industry representatives, local authorities and citizens. Newly founded [Centre for Integrated Design and Sustainability](#) at the Faculty of Architecture, Civil Engineering and Geodesy represents a ‘window’ for this interdisciplinary cooperation and real-life problem engagement. Cities, settlements, villages, buildings and landscapes of Bosnia and Herzegovina are considered as ‘laboratory’ where ideas, visions and scenarios about sustainable and resilient environment can be tested and refined. Study programme “Architecture and Urbanism” is conceptualised as a methodological combination of research and design, oriented towards integral observation of different spatial dimensions: architecture, city and wider territory.

### **Enrolment**

The University of Banja Luka and its Faculty of Architecture, Civil Engineering and Geodesy enrol students in Master Programme “Architecture and Urbanism” starting from the academic year 2017/2018. The access to programme is given to a person who achieved 240 ECTS during the previous education, i.e. a person who completed five-year or master academic degree in the field of architecture and urbanism.

The admission of candidates starts after public announcement. Candidates' ranking list for enrolment is formed based on average grade achieved during previous academic studies (max. 50 points) and results achieved at the entrance exam (max. 50 points). Foreign citizens may enrol in the study programme under the same conditions as national citizens, within the total envisaged number of students (number of perspective foreign students is 5).

# Competencies

## EU + BiH Qualifications of Second cycle studies (60-120ECTS)

The Dublin Descriptors are generic (non-subject specific) statements of the typical expectations of achievements and abilities associated with qualifications that represent the end of each Bologna cycle. They are built on the following elements: **knowledge and understanding, applying knowledge and understanding, generic cognitive skills, making judgements, communication skills and learning skills, learner autonomy accountability and working with others.**

have demonstrated a systematic understanding and mastering of knowledge in their field of study/discipline that is founded upon, and extends and/or enhances, that is typically associated with Bachelor's level, and that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research context;

can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study;

apply conceptual thinking and abstraction with a high level of proficiency and creativity, which will enable the:¾ critical evaluation of current research and academic work at the forefront of the discipline,¾ evaluation of different methodologies, development of critical opinion and the raising of alternative solutions;

have the ability to integrate knowledge and handle complexity, and formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements;

can communicate their conclusions, and the knowledge and rationale underpinning these using appropriate language(s), to specialised and non-specialised audiences clearly and unambiguously;

are able to take their own knowledge to a higher level, deepen the understanding of their field of study/discipline and continuously develop their own new skills through individual learning and self-development;

have the learning skills to allow them to continue to study in a manner that may be largely self-directed and autonomous;

have acquired interpersonal and teamwork skills appropriate to a variety of learning and employment contexts and also demonstrate leadership and/or initiative and make a contribution to change and development.

## EU qualifications of architects

Such studies shall be **balanced between the theoretical and practical aspects** of architectural training and shall ensure the acquisition of

an ability to create architectural designs that satisfy both aesthetic and technical requirements;

an adequate knowledge of the history and theories of architecture and the related arts, technologies and human sciences;

a knowledge of the fine arts as an influence on the quality of architectural design;

an adequate knowledge of urban design, planning and the skills involved in the planning process;

an understanding of the relationship between people and buildings, and between buildings and their environment, and of the need to relate buildings and the spaces between them to human needs and scale;

an understanding of the profession of architecture and the role of the architect in society, in particular in preparing briefs that take account of social factors;

an understanding of the methods of investigation and preparation of the brief for a design project;

an understanding of the structural design, constructional and engineering problems associated with building design;

an adequate knowledge of the physical problems and technologies and of the function of buildings so as to provide them with internal conditions of comfort and protection against the climate;

the necessary design skills to meet building users' requirements within the constraints imposed by cost factors and building regulations;

an adequate knowledge of the industries, organisations, regulations and procedures involved in translating design concepts into buildings and integrating plans into overall planning.

## Competencies Integral design: Architecture, City and Landscape

Integrating architectural, urban and landscape theory with a design-based research approach, the curriculum aims to address the contemporary urban challenges in terms of urban, environmental and social sustainability and resilience. Students will be equipped with conceptual and practical knowledge and tools to develop integrated approaches towards urban transformation.

### DISCIPLINARY COMPETENCES

**In-depth knowledge of theories and principles of sustainability and resilience, the relation between the two concepts and their declination in architectural, urban and landscape theories and design solutions.**

**In-depth knowledge of theories and principles that connect space and society, where the built environment and its functions are considered as human-environment system.**

**In-deep knowledge of the pressing contemporary spatial, environmental and social issues and the complex challenges of the urban society, both at local and global level.**

**In-depth knowledge of the historical development of contemporary ideas and theories in architecture, urban and landscape design.**

**In-deep knowledge of methods, tactics and tools for research and analysis of the built environment at different scales aimed at identifying integrated architectural, urban and landscape design solutions.**

### METHODOLOGICAL COMPETENCES

Curriculum will provide students with abilities:

**To think critically and to incorporate the dynamics of contemporary urban complexity and spatial phenomena within a clear conceptual framework;**

**To conduct a research through design, where the project is considered a producer of knowledge;**

**To initiate a contextual and flexible dialogue within the framework of a strategic bargaining with the different stakeholders or affected by the design proposal in order to achieve a better understanding of the implementation process;**

**To design a scenario based strategy and to promote a wider perspective on the consequences of decisions and actions on shaping the current and future built environment;**

**To develop capacity and skills to communicate and write about research and design process and outcomes.**

## **Compatibility with regulations, standards, guidelines and good practice**

Programme curriculum is based on: previous analysis of national education of architects and its compliance with the EU regulations; visibility of sustainability- and resilience-related topics in higher education regulations and in existing curricula; institutional capacities for the development of a new study program; existence of textbooks and other literature written in national language and/or covering issues of national relevance; results of students' surveys and teachers' questionnaires that revealed an interest for sustainability- and resilience-related topics and the development of a corresponding academic programme.

Master Programme "Architecture and Urbanism" is equivalent to the level 7 of the International Standard Classification of Education (ISCED) and the level 7 of the European Qualifications Framework (EQF). The programme is in line with the Bologna Principles, national regulations in the field of higher education, EU and Bosnia and Herzegovina Qualifications for Second Cycle Studies, and the EU Qualifications for Architects.

The structure and content of programme are in line with 2017-2025 Development Strategy of the University of Banja Luka, Strategy for Scientific and Technological Development of the Republic of Srpska 2017-2021, UNESCO Global Action Programme for Education for Sustainable Development, and the Goals of the Agenda 2030 for Sustainable Development.



# ENERGY EFFICIENCY OF SETTLEMENTS

## **Academic Master Programme**

State University in Novi Pazar – Department of Technical Sciences

1-year (60 ECTS credits) study programme of master academic studies “Energy Efficiency of Settlements” at the State University in Novi Pazar – Department of Technical Sciences Programme was developed on the basis of the realistic need of local governments and institutions in the region, as well as the need of different companies, for professionals with technical knowledge who are educated to deal and work in the specific field of energy efficiency, resilience and sustainability of the built environment, and who are able to respond to actual problems, recommendations and policies of the Republic of Serbia, Western Balkans Region and the European Union.

Programme provide architects, urban designers, planners, civil engineers with knowledge and awareness of energy efficiency and capacity of settlements to adapt and be resilient to overall climate and microclimate changes. Programme also provides a possibility to students to meet with the emerging novelties in the context of energy efficiency of building materials and building technologies. By studying the best evidence cases, students in programme learn about positive and progressive legislative imputes on all levels from local/national/international, and the benefits of their timely implementation, and gain ability to propose further improvement of legislative and regulative frameworks in the field of study.

Programme is designed to give students an opportunity to study, individually or in groups, different topics related to the above-mentioned themes, and to give answers to different problems preferably identified in regional/local spatial scales, by drawing a parallel with the European/worldwide experiences and good practices.

To achieve good results, students are offered various educational methods that enable them to cope in an optimal manner with programme topics and assignments. During the studies, students will master the practice of new design and adaptation, reconstruction and

transformation of existing buildings, as well as the existing urban tissues, and local, national and/or EU recommendations, regulations, finally the legislation, will play an important role in this process.

## Curriculum

The curriculum of programme “Energy Efficiency of Settlements” provides students with the subjects encompassing fields of architecture, urban planning, design and management, and civil engineering. Education in programme is organised within mandatory and elective courses, through lectures, exercises, study research work, consultations, individual and team work in the **Centre for Sustainability and Resilience of the Built Environment** established in the framework of the project KLABS, Regional Centre for Energy Efficiency, Laboratory for the Examination of Building Materials, etc. At the course Preparation and Defence of Master Thesis, during the second semester, students focus on individual study research work.

### COURSE LIST

## PROGRAMME ENERGY EFFICIENCY OF SETTLEMENTS

### SEMESTER 1

30 ECTS

- 
- |     |  |
|-----|--|
| 1   | Energy Efficiency of Buildings and Settlements 6 ECTS                |
| 2   | Municipal Systems in the Context of Climate Change 6 ECTS            |
| 3   | Energy Efficiency of Transport in Settlements 6 ECTS                 |
| 4   | Waste Management 6 ECTS  |
| 5   | Elective Course 6 ECTS   |
| 5.1 | Energy Efficient and Environment Friendly Materials and Technologies |
| 5.2 | Energy Efficiency and EU Legislation and Funds                       |

### SEMESTER 2

30 ECTS

- 
- |   |  |
|---|--|
| 6 | Municipal Policies of Energy Efficiency 5 ECTS   |
| 7 | New Renewable Sources of Energy 5 ECTS           |
| 8 | Preparation and Defence of Master Thesis 20 ECTS |

## Learning methods, IT and e-learning

Students at programme will benefit from the Centre for Sustainability and Resilience of the Built Environment, Regional Centre for Energy Efficiency and Laboratory for the Examination of the Built Materials within SUNP, and from utilization of various software necessary for their specific work. MOODLE platform is on disposition to students and teachers for storing the learning material and exchanging the courses on-line. The collection of published

material developed within the project KLABS – [Reviews of Sustainability and Resilience of the Built Environment for Education, Research and Design \(TU Delft Open, 2018\)](#) – is available to students in electronic format via open access.

## **Integration of research with education**

The major part of courses at the Master Programme encourage students to apply research methodology to a certain extent, individually or in groups. Cooperation with regional and local governments, municipalities and services, and easy access to business, in particular enable practice orientated research that is supposed to lead to a more successful future professional work, and also represents a good preparation for doctoral academic studies.

## **Enrolment**

Master Programme “Energy Efficiency of Settlements” is intended for engineers of Architecture, Civil Engineering, Mechanical Engineering, Urban Design, Urban Planning, who completed 4-year programmes and earned at least 240 ECTS during their previous education. Candidates who completed different academic studies will take differential exam.

The enrolment of students will start upon obtaining of the national accreditation. The University will enrol 20 students in the first year of study programme. Candidates' ranking list for enrolment will be formed according to the average grade achieved during the previous academic studies.

## **Competencies**

Students who completed Master Programme “Energy Efficiency of Settlements” will be enabled to work individually or in a state or public institution, enterprise or company.

Professionals with Master in Energy Efficiency will acquire the following competences:

- Ability to understand basic theoretical, methodological and practical implications of different theoretical systems and models,
- Ability to individually detect problems, abstract and define them in a way to enable scientific or professional researches,
- Ability to plan, design, and conduct researches in different segments of energy efficiency field,
- Ability to precisely conceive findings of own and other's research and to competently present them to academic public in narrative or written form,
- Ability to realize team communication and take over the organizational and leadership role in team work,

- Ability to show sensibility for ethical dilemmas and find solutions according to general moral principles and ethical code of conduct of the profession,
- Ability to understand and apply knowledge of energy efficiency in planning of new and/or making interventions on existing buildings, complexes and settlements,
- Ability to understand and apply principles of construction, function and aesthetic in the design of new and reconstruction of existing buildings, complexes and settlements, according to the principles of energy efficiency.

### **Compatibility with regulations, standards, guidelines and good practice**

Master Programme “Energy Efficiency of Settlements” that represents the outcome of the Erasmus+ project "Creating the Network of Knowledge Labs for Sustainable and Resilient Environments – KLABS”, is compatible with the European and other international standards and higher education trends (Bologna Principles, European Framework for Quality Assurance in Higher Education, guidelines and results of European projects in the fields of lifelong learning and short-cycle programmes, UNESCO Global Action Programme for Education for Sustainable Development, conclusions of the Council of the European Union on education for sustainable development, Goals of the Agenda 2030 for Sustainable Development, and other), as well as with the justified areas of specialization for engineers from technical-technological field.

Programme is harmonized with other programmes at the State University in Novi Pazar, enabling the engineers of different profiles to directly continue their education and acquire new, advanced knowledge, skills and competencies in the field of energy efficiency. The structure and content are in line with national regulations in the field of higher education, national standards for technical-technological sciences, Strategy for the Development of Education by 2020, Action Plan for the Implementation of the Strategy for the Development of Education by 2020, Strategy for Sustainable Development, Law on Efficient Energy Use, etc.



# ENVIRONMENTAL INFRASTRUCTURE MANAGEMENT

## Academic Master Programme

"Džemal Bijedić" University of Mostar – Faculty of Civil Engineering

2-year (120 ECTS) Master Programme "Environmental Infrastructure Management" at the "Džemal Bijedić" University of Mostar – Faculty of Civil Engineering was developed within the EU Erasmus+ capacity building project in the field of higher education entitled "Creating the Network of Knowledge Labs for Sustainable and Resilient Environments" (KLABS). The programme is intended for students with background in technical sciences, allowing them to develop specialised knowledge about urban infrastructure and its environmental management. The need for study programme has emerged from the lack of experts in subject area of study in Bosnia and Herzegovina. Namely, market analysis has shown that there exists a growing need for professionals with the knowledge about the management of resources within the built environment.

The aim of programme "Environmental Infrastructure Management" is to educate engineers who are skilled to: identify the need for establishment or construction of municipal equipment, facilities or organizational forms; design, execute and supervise infrastructural projects related to water supply and protection, waste management, etc.; develop project proposals and models of financing, including support from international organisations in appropriate cases; identify indicators and tools for sustainable development; and to apply new engineering materials.

By mastering study programme, students gain specialised knowledge in the fields of soil and rock mechanics, renewable sources of energy, management and maintenance of roads, construction durability, energy efficiency in construction industry (passive low-energy buildings), Geographic Information System (GIS); urban planning and design, etc.

## Curriculum

COURSE LIST

### PROGRAMME ENVIRONMENTAL INFRASTRUCTURE MANAGEMENT

#### SEMESTER 1

30 ECTS

- 1 Mathematics for Engineers III / Operational Research 6 ECTS
- 2 GIS and Zoning (Municipal Utilities) 6 ECTS
- 3 Technical Equipment of Facilities and Settlements 6 ECTS
- 4 Elective Course 5 ECTS
- 5 Elective Course 5 ECTS
- 6 Expert Project - Studio Work 2 ECTS

Electives

Water Protection  
Soil and Rock Mechanics II  
Building Optimization  
Indicators and Tools for Sustainable Development  
Urban Planning and Environment  
Building Physics

#### SEMESTER 2

30 ECTS

- 1 Management of Communal Water Supply Enterprises / Sustainable Water Management in the Local Community 6 ECTS
- 2 Management and Maintenance of Roads 6 ECTS
- 3 Waste Management 6 ECTS
- 4 Elective Course 5 ECTS
- 5 Elective Course 5 ECTS
- 6 Expert Project - Studio Work 2 ECTS

Electives

Hydropower (SHP)  
Landfills  
Materials for Energy Efficient and Sustainable Buildings  
Resilient and Sustainable Renewable Sources of Energy  
Passive and Low-Energy Buildings  
Sustainable Buildings Made of Natural Materials

#### SEMESTER 3

30 ECTS

- 1 Investment and Project Management / Business Correspondence to EU Funds 5 ECTS
- 2 Geotechnical Aspects of Waste Landfills 5 ECTS
- 3 Construction Durability, Resilience and Maintenance 5 ECTS
- 4 Elective Course 5 ECTS
- 5 Elective Course 5 ECTS
- 6 Studio Project 5 ECTS

Electives

Wastewater Disposal  
Special Types of Concrete  
BIM  
Urban Ecology – Resilience and Adaptability in the Urban Environment  
Energy Efficiency, Sustainability and Resilience in the Construction Industry  
Energy Efficiency During Building Reconstruction and Retrofit

#### SEMESTER 4

30 ECTS

- 1 Master Thesis 30 ECTS

The curriculum of study programme “Environmental Infrastructure Management” is structured in a way to enable acquisition of knowledge from the fields of urban water and waste management, road management, renewable energy sources, energy efficiency, materials, durability of structures, and related disciplines such as urban planning, building construction and design, etc.

Programme consists of mandatory and a large number of elective courses, spread over the first three semesters. Courses feature different teaching, and individual and peer learning techniques. Beside regular work in the classroom and on the field, every of first three semesters has a specially designed subject – Expert Project – organised as Studio. Master thesis is realized as individual students’ work in the final – fourth semester. At the end of the third semester, students define the topic for their master thesis.

### **Learning methods and approaches**

Study programme “Environmental Infrastructure Management” offers an array of contemporary learning methods suited for the field of study, thus representing an innovation on institutional and national levels.

During the development of study programme, special attention was given to the links with society and the creation of knowledge triangle. To that end, Studio Program – made out of Expert project and Studio project – was introduced in three semesters as an optimal pedagogical format. During their work in Studio, students combine knowledge from various subjects and disciplines, and establish collaboration with external representatives from public and enterprise sectors.

Studio allows for the acquisition of practical knowledge and skills that are indispensable for engineering profession. Interdisciplinary studio environment and interdisciplinary methodology are supported by corresponding topics offered at other programme courses, primarily in relation to the instruments and tools of sustainable development, energy efficiency, building optimization, sustainable energy sources, sustainable communal management, waste water disposal, geotechnical aspects of landfill, and management and maintenance of the roads. With such an approach, students get good understanding of complexity of infrastructure systems, and develop knowledge and skills to plan, design, execute or supervise the realisation of creative technical solutions.

Design and research assignments in Studio are based on real-life cases. Topics are selected in accordance with the possibilities of cooperation with the industry and construction and communal companies from Herzegovina region, and are closely related to the contemporary requirements for sustainable and resilient urban environment. The aim is to identify problems and opportunities for the improvement of critical infrastructure in terms of ecological quality, functionality, network development, adaptation to climate change, resistance to extreme weather conditions, etc. To-date, students got an opportunity to develop projects for Mostar historical urban core and Mostar collector, among others. Although the main subject of observation is the city, its relationship with the suburbs, towns and villages are considered as equally relevant. The collection of open access books – [Reviews of Sustainability and Resilience of the Built Environment for Education](#),

**Research and Design (TU Delft Open, 2018)** – developed during the implementation of KLABS project, features several chapters dealing with the particular context of the city of Mostar and its current spatial challenges.

Studio topics intend to build knowledge about the impact of infrastructure systems on the quality of human life and the environment, to raise awareness of the consequences of professional decisions and procedures, and to encourage students' critical reflection on possibilities and concrete ways of action – not what can be done, but what and how is to be done. The ultimate goal is a contribution to better quality of life, more durable and sustainable urban environment and the infrastructural and economic systems that make it.

### **Integration of research with education**

Programme “Environmental Infrastructure Management” integrates research with the education in the Studio environment. Each semester, with the help of mentors and other teaching staff, students apply suitable methodology to selected real-life problems and learn how to connect research with the practical work. Students explore a particular system critically, identify what is a desired change within that system, and propose concrete solutions.

Presentations of achieved students' results are given at the end of every semester. The audience at public presentation at the end of the third semester includes not only teaching staff and peer students, but also guest representatives from public and enterprise sectors. In that way, the students are given an opportunity to present themselves to the possible future employers.

While doing research and preparing their final thesis, the students are encouraged to use the **Centre for Sustainable Environment** – sub-organizational unit at the Faculty of Civil Engineering founded in the framework of KLABS project.

### **Enrolment**

Master Programme “Environmental Infrastructure Management” is intended for students with bachelor diploma in technical sciences. The access to programme is given to a person who achieved at least 180 ECTS during the previous education, i.e. a person who completed three-year education in the field of technical sciences.

The Faculty of Civil Engineering of the “Džemal Bijedić” University of Mostar enrolls students in Master Programme “Environmental Infrastructure Management” starting from the academic year 2017/2018.

No entrance exam is required. The admission of candidates starts after publication of the public announcement. Candidates' ranking list is formed according to the average grade achieved during previous academic studies and the assessment of motivational letter in which candidates argue their interest in study program.

Foreign citizens may enrol in programme under the rules of the "Džemal Bijedić" University of Mostar.

## Competencies

By mastering study programme, students acquire the following general and subject-specific competencies that are in the function of carrying out the professional and research activities in a good quality manner:

- Understanding of important social, ecological and economic today's challenges, universally and in local/regional contexts,
- Knowledge and understanding of the principles of water management and management of communal companies, and ability for high-level business performance in the field of water and utility management in local and regional contexts,
- Knowledge and understanding of the management of companies for planning, design, construction, supervision and maintenance of the roads, and the ability for high-level business performance in local and regional contexts,
- Knowledge and understanding regarding durability of materials and constructions, renewable sources of energy, and energy efficiency, and the ability for high-level business performance in local and regional contexts,
- Comprehensive understanding and ability to integrate engineering knowledge and skills with the management-related knowledge and skills regarding infrastructural systems, energy resources, durability of structures, and energy efficiency,
- Ability to respond to real circumstances and conditions in local/regional environment, to evaluate the current state, identify and formulate relevant problems, analyse different methodologies, conduct research and derive optimal solutions,
- Management of skills and methods of research work in encompassed area of study,
- Systemic, critical and self-critical thinking, perception and approach, and ability to provide individual contribution to integrated solutions,
- Interdisciplinary skills and teamwork skills appropriate for various learning and business environments,
- Ability to run/start the initiatives and to contribute to the development of environmental systems,
- Ability to use professional language, carry out two-way professional communication and to develop collaboration with the social and business actors,
- Understanding and acting in accordance with the principles of professional philosophy, politics and ethics.

## Compatibility with regulations, standards, guidelines and good practice

The programme “Environmental Infrastructure Management” is in line with the European and other international standards and higher education trends: Bologna Principles, European Framework for Quality Assurance in Higher Education, guidelines and results of European projects, UNESCO Global Action Programme for Education for Sustainable Development, conclusions of the Council of the European Union on education for sustainable development, Goals of the Agenda 2030 for Sustainable Development, finally the recommendations given by KLABS partners.

The following curricula were taken as examples during the development of Master Programme “Environmental Infrastructure Management”:

- 4-semester master programme “Clima Design”, TU Munich, Faculty of Architecture;
- 4-semester “Master Track of Building Technology”, TU Delft, Faculty of Architecture;
- Master programme in Architectural Engineering “Environmental Design”, University of Bath, Faculty of Engineering & Design;
- Post-master programme “Smart Energy Buildings & Cities”, School for Technological Design, Stan Ackermans Institute;
- Master programme “Advanced Urbanism” – AdUrb, Bauhaus-Universität Weimar in cooperation with College of Architecture and Urban Planning (CAUP) at Tongji University Shanghai (China);
- Master programme “Integrated Urbanism and Sustainable Design”, University of Stuttgart in cooperation with Ain Shaims University, Cairo;
- Master of Advanced Studies in Sustainable Building, Berner Fachhochschule, Fachhochschule Nordwestschweiz, Hochschule Luzern, HTW Chur, ZHAW Zürich;
- Master in International Material Flow Management, Environmental Campus Birkenfeld (ECB) and partner universities in Japan, Turkey, Brazil and Morocco; and
- Postgraduate specialist programme “Environmental Municipal Infrastructure”, University of Sarajevo, Faculty of Mechanical Engineering.

The structure and content of developed programme correspond to the national regulations in the field of higher education and the internal institutional acts regarding quality assurance.

Accreditation of study programmes in the Federation of Bosnia and Herzegovina is not implemented as such. The process of accreditation only refers to the universities, and “Džemal Bijedić” University of Mostar is accredited higher education institution.



# SUSTAINABILITY AND RESILIENCE OF THE BUILT ENVIRONMENT

## **Academic Specialist Programme**

University in Kosovska Mitrovica – Faculty of Technical Sciences

Study programme of specialist academic studies “Sustainability and Resilience of the Built Environment” at the Faculty of Technical Sciences in Kosovska Mitrovica was developed within the European Union Erasmus+ capacity building project in the field of higher education, entitled “Creating the Network of Knowledge Labs for Sustainable and Resilient Environments – KLABS”.

The programme was designed to equip master engineers in architecture, civil, electrical, mechanical, technological and environmental engineering with advanced – specialized knowledge about sustainability and resilience of the built environment to climate change, environmental protection of urban and rural areas, utilisation of natural resources in the built environment, sustainability and resilience assessments, risk assessment, application of integrated engineering measures, and management, and to enable mastering of research methodology and the methods of linking research with practical work.

With the support of appropriate educational methods and adequate teaching organization, the students grouped in multidisciplinary teams have an opportunity to collaborate, to exchange knowledge from their engineering fields and to acquire new specialized knowledge and skills. The purpose of programme is to educate specialist engineers who understand the complexity of problems related to sustainability and resilience of the built environment, and their cause-and-effect relationships, and are able to approach these problems in a comprehensive, transdisciplinary way while retaining at the same time their own engineering profession and acting from the own professional position. Specialist engineers in corresponding scientific area within the technical-technological field (with the indication - sustainability and resilience of the built environment in diploma supplement) are professionally equipped to act in circumstances characterized by complexity, frequent and significant changes, risks and uncertainty.

Programme structure was built upon a realistic need for specialist engineers who, by acquiring new interdisciplinary knowledge, skills and competencies in technical-technological field, become qualified to work at engineering, design and management positions within the enterprises, organizations, institutions, associations, and companies dealing with the various aspects of sustainability and resilience of the built environment. Owing to acquired competencies, specialist engineers are in position to introduce sustainability and resilience of the built environment as a novelty (but also a need) in their working environment.

Having regarded that sustainability and adaptation of the built environment to climate change have gained scientific-educational relevance over the last decade, earlier generations of engineers have not been educated in accordance with the needs of today's society and profession. For that reason, Specialist Programme "Sustainability and Resilience of the Built Environment" is open both to the engineers who completed previous level of education just before submitting the enrolment documents, and the engineers of corresponding profiles who are working and coming back to education to update their knowledge and skills according to contemporary trends and needs.

## Curriculum

The curriculum of Programme "Sustainability and Resilience of the Built Environment" at the Faculty of Technical Sciences in Kosovska Mitrovica is structured in a way to enable acquisition of knowledge from the fields of architecture (and urbanism), civil engineering, electrical engineering, mechanical engineering, environmental engineering, and related disciplines.

Programme consists of mandatory and elective courses, and a series of educational forms such as lectures, exercises, work in the **Laboratory for Sustainability and Resistance of the Built Environment** established in the framework of the project KLABS and the Laboratory for Renewable Energy Sources, study research work, work in studio, consultations, professional practice, individual work, etc.

Group work in Studio in the second semester gives students an opportunity to apply previously acquired knowledge to a concrete, real problem, or to integrate research and mastered theoretical knowledge from various courses with practical work, and thereby to qualify for future successful work in practice.

The course Professional Practice includes 90-hour professional program in a company, knowledge assessment, and the defence of a written student's work developed in accordance with executed practice.

Study research work within the course Specialist Work equips students with the capability to conduct individual research work.

## COURSE LIST

### PROGRAMME SUSTAINABILITY AND RESILIENCE OF THE BUILT ENVIRONMENT

#### SEMESTER 1

30 ECTS

- 
- |                            |  |
|----------------------------|--|
| 1                          | Sustainability, Resilience and the Built Environment 3 ECTS            |
| 2                          | Research Methods 3 ECTS  |
| 3-8: Electives             | Management in Context of Sustainability and Resilience 4 ECTS          |
|                            | Systemic Risk Analysis 4 ECTS  |
|                            | Assessments of Sustainability and Resilience 4 ECTS                    |
|                            | Material and Waste Flows and the Principles of Circular Economy 4 ECTS |
|                            | Material Impacts 4 ECTS  |
|                            | Renewable Energy Sources 4 ECTS  |
|                            | Climate, Envelope and Indoor Environment 4 ECTS                        |
|                            | Energy Modelling 4 ECTS  |
|                            | Water and the Built Environment 4 ECTS                                 |
|                            | Aspects of Water Utilisation in Buildings 4 ECTS                       |
|                            | Land Use and Masterplan 4 ECTS   |
|                            | Greening Strategies 4 ECTS   |
| Intelligent Systems 4 ECTS |  |

#### SEMESTER 2

30 ECTS

- 
- |    |                              |
|----|------------------------------|
| 9  | Integrated Studio 12 ECTS    |
| 10 | Professional Practice 3 ECTS |
| 11 | Specialist Work 15 ECTS      |

#### Learning methods, IT and e-learning

Work in the **Lab for Sustainability and Resistance of the Built Environment** foresees the utilisation of software for energy simulations and the life cycle assessments. Programme is supported with the on-line connectivity software for virtual classes of guest lecturers from other higher education institutions in the country and abroad, that is, the lecturers from commerce and other external sectors. Faculty's TV studio with high-quality equipment enables students and teachers at the programme to prepare, exchange and disseminate various promotional and educational video material. Programme also implies the use of Faculty's existing electronic platform for storing of teaching and learning materials. **Virtual library** with a large number of e-books acquired within the KLABS project forms part of this platform. The collection of published material, designed and developed according to the content and needs of study programme, entitled **Reviews of Sustainability and Resilience of the Built Environment for Education, Research and Design** (TU Delft Open, 2018), is available to students in electronic format through open access.

## **Learner-centred approach**

Specialist Programme “Sustainability and Resilience of the Built Environment” offers flexible learning paths based on learning outcomes. Students are given a possibility to select topics from a large number of elective courses, according to their individual profession, interests and plans for future career development. The percentage of elective courses in study programme is 85.00%.

## **Integration of research with education**

Programme contains the course Research Methods, and study research work with the course Specialist work, aimed to enable students to conduct independent research work by applying scientific methodology, processes and procedures. In addition, through the work on specific topics and tasks in other programme courses, students master the methods of linking the research with practical work. Integration of research with education (and practice) empowers students to successfully deal with real and complex sustainability- and resilience-related problems in professional work, as well as to continue their education at doctoral academic studies in the country or abroad.

## **Enrolment**

The Faculty of Technical Sciences in Kosovska Mitrovica enrolls students in Specialist Programme “Sustainability and Resilience of the Built Environment” starting from the academic year 2017/2018.

The access to study programme is given to a person who achieved at least 300 ECTS during the previous education, i.e. a person who completed five-year or master academic degree in technical-technological scientific field and narrower areas corresponding to the programme character: architecture, civil, mechanical, electrical, technological and environmental engineering.

The admission of candidates starts after public announcement. Candidates' ranking list for enrolment is formed based on the following criteria:

- Average grade achieved during previous academic studies (max. 55 points),
- Average grade from relevant courses in previous academic studies (max. 15 points),
- Period of time in which previous studies were completed (max. 5 points),
- Content of portfolio with academic and professional experience, and recommendations (max. 15 points), and
- Motivational letter where candidates argue their interest in study programme, describe work experience, i.e. previously acquired knowledge, skills and competences, and present career development plan and other relevant facts (max. 10 points).

If several candidates achieve equal number of points during the evaluation, enrolment commission will organize interviews with individual candidates for final examination of abilities and bring final decision on admission to the studies.

The right to enrol is given to candidates whose position on the ranking list is within the number defined for enrolment.

Foreign citizens may enrol to the studies "Sustainability and Resilience of Built Environment" under the same conditions as national citizens, within the total envisaged number of students. The basic requirement for enrolment in study programme is adequate knowledge of the Serbian language. Verification of national language knowledge is performed by a three-member commission appointed by the Dean of the Faculty.

## Competencies

By mastering specialist studies "Sustainability and Resilience of the Built Environment" students acquire general and subject-specific competencies that are in the function of carrying out the professional and research activities in a good quality manner.

Students acquire the following **general competencies**:

- Understanding of the most important social, ecological and economic today's challenges,
- Systemic, critical and self-critical thinking, perception and approach,
- Ability to respond to real circumstances and conditions in the environment, to identify and analyse problems, offer solutions and anticipate the consequences,
- Ability to identify and apply appropriate methods, procedures and research processes, as well as the ability to independently present research results to different social groups,
- Ability to use professional specialized terms, carry out two-way professional communication and to develop collaboration with the social environment,
- Ability to work in a multidisciplinary team, among different social actors and the ability to lead teams, and
- Understanding and acting in accordance with the principles of professional philosophy, politics and ethics.

Sustainable development and adaptation to climate change in engineering branches belonging to the technical-technological field relate to the development, analysis and implementation of a wide range of appropriate technical and technological solutions, measures and practices. By mastering the study programme, students gain the following **subject-specific competences**:

- Holistic understanding of the concepts of sustainability and resilience and their interconnections in the built environment,
- Understanding the responsibilities and challenges set in front of engineers in terms of sustainability and resilience of the built environment,

- Ability to independently research sustainability and resilience of the built environment at different levels, to conduct analyses, experiments, assessments and evaluations, as well as the ability to synthesise and interpret results, formulate conclusions, and present the research in written and oral form,
- Ability to independently and critically evaluate current engineering practice, identify and formulate relevant problems, and provide optimal, innovative and creative engineering responses, i.e. the solutions for achieving sustainability and resilience of the built environment,
- Ability to provide individual contribution to systemic, integrated solutions,
- Ability to develop engineering projects and processes for the built environment which sustains good quality and rationally uses natural resources (energy, raw materials, water and land),
- Ability to systematically manage complex projects and processes for sustainable and climate-resilient development and the ability to cooperate with different actors,
- Ability to initiate changes in professional environment, and to develop new initiatives or establish enterprises, organizations, companies, associations, etc.,
- Ability to apply acquired knowledge and skills in following the novelties, developing new specialized knowledge, as well as in further education and skills development, and
- Ability for advanced utilisation of computer technologies and software.

**Qualifications that mark the completion of specialist academic studies** are acquired by the students who demonstrated:

- Understanding of the complexity of sustainability and resilience in the built environment and of their interrelations, ability for critical analysis by using different developed approaches, as well as the ability to develop an argumentative discussion related to the issues of sustainability and resilience from the ecological, economic and socio-cultural aspects,
- Systemic and critical thinking, analytical skills, professional language proficiency, ability to express own professional attitude and to carry out two-way professional communication,
- Understanding of professional ethics, role of specialist engineers, importance of personal and collective moral procedures and values, importance of providing individual professional contribution to common solutions, and the importance of management in the context of generally accepted concepts of sustainability and resilience,
- Ability to apply and link acquired deep knowledge, and understanding and ability to solve objective problems of different degrees of complexity, in relation to specific aspects of sustainability and resilience of the built environment covered by the content of study programme,
- Understanding of the research process and mastering the research methods, and ability to carry out independent research, synthesise and interpret results, formulate conclusions and present the research in written and oral form, and

- Ability to integrate research results with practical professional work, to initiate new research based on the results of practical professional work, i.e. to simultaneously conduct research and engage in solving specific problems in practical professional work.

### **Compatibility with regulations, standards, guidelines and good practice**

Specialist Programme “Sustainability and Resilience of the Built Environment” is in line with the European and other international standards and higher education trends (Bologna Principles, European Framework for Quality Assurance in Higher Education, guidelines and results of European projects in the fields of lifelong learning and short-cycle programmes, UNESCO Global Action Programme for Education for Sustainable Development, conclusions of the Council of the European Union on education for sustainable development, Goals of the Agenda 2030 for Sustainable Development, recommendations for the implementation of education for sustainable development, i.e. general sustainability competences, and other), as well as with the justified areas of specialization for engineers in the technical-technological field.

Programme is holistic, comprehensive and harmonized with other programmes at the Faculty of Technical Sciences, which enables master engineers of different profiles to directly continue their education and acquire new, advanced knowledge, skills and competencies within the seventh level of the European Qualifications Framework.

The structure and content of study programme are in line with national regulations in the field of higher education, national standards for technical-technological sciences, Strategy for the Development of Education by 2020 that envisages the concept of interdisciplinary education for sustainable development, Strategy for Sustainable Development, Strategy for Sustainable Use of Natural Resources and Goods, National Strategy for Approximation in the Field of Living Environment, as well as with other regulations and guidelines for the development of higher education according to the most important current needs of society.

In the part dealing with the development of higher education, National Strategy for the Development of Education by 2020 recommends flexibility of higher education system through the introduction of short-cycle studies (up to 60 ECTS). One-year programme “Sustainability and Resilience of the Built Environment” was developed according to this recommendation. In line with the Strategy, the elements of research (within a number of courses) and the contents that encourage entrepreneurship (course Management in the Context of Sustainability and Resilience) and improve practical skills and competences (the largest number of courses are by type professional-applicative) were introduced into programme. New methods, supported by information technologies, were also embodied in the programme, and, through the implementation of the Erasmus + project "Creating the Network of Knowledge Labs for Sustainable and Resilient Environments", the adequate computer equipment, software and library units were acquired. At the same time, the students are provided with the open access to learning material through electronic platform that exists at the Faculty of Technical Sciences, which further modernizes the education.

Specialist Programme “Sustainability and Resilience of the Built Environment” is related to the following actions of the Action Plan for the Implementation of the Strategy for the Development of Education by 2020: VO-ZD03; VO-ZD04; VO-ZD06; VO-ZD15; VO-ZD16; VO-ZD18; VO-ZD19; VO-ZD21; VO-ZD22; VO-ZD23; VO-ZD25; VO-ZD29; VO-AS01; VO-AS04; VO-AS06 and VO-AS10.



Универзитет у Београду - Архитектонски факултет  
University of Belgrade - Faculty of Architecture

# ENERGY EFFICIENT AND GREEN ARCHITECTURE

## **Academic Specialist Programme**

University of Belgrade – Faculty of Architecture

Study program of specialist academic studies Energy Efficient and Green Architecture at the University of Belgrade – Faculty of Architecture was developed 2009-2011 and accredited in 2012 and was further improved within the European Commission Erasmus+ capacity building project in the field of higher education entitled “Creating the Network of Knowledge Labs for Sustainable and Resilient Environments” (KLABS). The study program was reaccredited in 2018, with the modified curriculum.

The modern concept of building design and construction increasingly involves issues of sustainability, that is, respect and care for the environment in which we are building. This implies an integral and multidisciplinary knowledge of the behaviour of the facility and the installation systems in its composition, the active care of the energy we spend, but also the resources in general, and in that sense today we are talking about energy efficient and / or green architecture. The mentioned problems and concepts of green building require a better knowledge of the overall behaviour of buildings in relation to the environment in which they are located, the respect of the climatic conditions in which a building is built, the adequate choice of materials and construction technologies, and they are increasingly subject to the relevant regulation that specifically define the needs, directions and modes of design and construction. In that sense, it is also important that the adoption of a set of rules on energy efficient buildings as the legal basis recently established in our environment and incentive for this kind of design and construction.

Having in mind the stated postulates of modern construction, which, as the imperative of future construction, require the deepening of the knowledge necessary for the design, construction and evaluation of energy efficient and green buildings, this study program represents a concrete answer to the needs of current construction practice. The specialist academic studies program should enable students to further concretize their knowledge

necessary for understanding, designing and building energy efficient and green buildings, to master complementary professional knowledge from other areas of technical science relevant to such facilities, or to acquire the capacity to integrate knowledge which are necessary for solving such a complex task, while being introduced into the research process and work.

The 1-year, 60 ECTS study programme was designed striving to provide the most up-to-date theoretical and practical knowledge in the area of energy-efficiency and green architecture to engineers practicing various disciplines – architecture, civil engineering, mechanical engineering, electrical engineering etc. The broader objective is to support the modernization of higher education in WB Region by implementing a strategic approach in the development of an innovative platform for the delivery of knowledge about sustainable and resilient environments, with special focus on the issues of energy efficiency and green building. The specific aims of study program include expanding the knowledge necessary for designing, construction and evaluation of energy-efficient and green buildings, acquiring the professional qualification (the entry basis for 381 licence) for the work in the area of energy-efficiency and energy certification of buildings and acquiring the professional qualification as an entry basis for taking the exam and obtaining the title LEED Green Associate (LEED GA).

The structure of the programme was built upon realistic need for specialist engineers who are, by acquiring new interdisciplinary knowledge, skills and competencies in technical-technological field, educated for work on engineering, design and management positions within the enterprises, organizations, institutions, associations, companies, etc. dealing with various aspects of sustainability and resilience of the built environment. Owing to acquired competencies, specialist engineers are in a position to address a broad spectrum of issues related to energy efficient and green building in their working environment.

The lecturers in the specialist studies are the most eminent experts in the relevant areas, Chamber of Engineers' examiners and lecturers, initial licence 381 holders, LEED AP BD+C, Level 1 Thermographer, etc. The lecturers take part in the current international and national research and professional projects in the area of energy-efficient and green architecture, contribute actively to legislative framework formation in the area of energy efficiency and they are authors of numerous publications available to the candidates for the work and research in the course of the specialist studies.

The academic specialist study program Energy Efficient and Green Architecture is designed and structured in a way that enables the engineers with the professional experience to gain new competences and knowledge and, at the same time, provides specific knowledge and skills to the graduated students that are not covered by the bachelor and master studies at the engineering faculties.

## Curriculum

The curriculum of academic specialist study programme Energy Efficient and Green Architecture at the University of Belgrade – Faculty of Architecture is structured in a way to enable acquisition of core theoretical knowledge from the relevant fields and disciplines and

then develop professional skills that enable the students to effectively apply the gained knowledge and further expand it through their own research.

The study programme stretches through two semesters – the mandatory courses focused predominately on core theoretical knowledge are in the first semester while the second semester is dedicated to elective courses, studio work and professional practice, finishing with the thesis research and the final thesis. This concept allows each student to gradually steer his/her studies while retaining the wider context and constantly broadening the knowledge.

The program is delivered through academic-general education, theoretical-methodological, scientific-professional and professional-applied teaching organized in the form of compulsory and elective courses. Elective courses are selected from a group of proposed subjects. Students have the opportunity to choose an optional subject of another study program at a faculty or university, in the second semester of studies, according to their own preferences and wishes, with the consent of the study program leader and the approval of the vice-dean for teaching. If the chosen subject is outside the study program, it should enable the extension of knowledge in areas that are directly or indirectly related to the issues of sustainable architecture, and at the same time must be fulfilled and the preconditions prescribed for the selected subject.

Teaching is carried out through various methods through lectures, short exercises, research and design studio, seminars, consultations, research work, professional practice, independent study research work, as well as other forms of teaching and research work. The result of attending classes on each course is expressed by a unique grade obtained from the points earned. Knowledge checking is performed during the semester and after the completion of active teaching through the preparation and defense of project or elaborate exercises, tests, colloquiums, seminar papers and (written or oral) exams.

An integral part of specialized academic studies "Energy Efficient and Green Architecture" is a professional practice, that is, a practical work for 45 hours, which is realized in the appropriate institutions and organizations whose activity is related to the profession for which the student is able to be trained. Checking the acquired knowledge is done through the elaboration and defense of the relevant study.

The student completes a specialist academic study by developing a specialist work consisting of theoretical and methodological preparation and the final work. Preparation for the final work is a self-study of the student necessary for a better understanding of the areas from which the specific specialist work is done, as well as for the conception of the work itself, which results in the application of the topic of specialist work. The final work is defended before a panel consisting of at least 3 teachers. The final assessment of specialist work is carried out on the basis of an assessment of theoretical and methodological preparation and assessment of the design and defense of the work itself.

The newly formed **Research Unit for Sustainable and Resilient Architecture (SaRA)** provides the space, equipment and software for the students to execute research work, consultations, professional practice, individual work, etc. as well as to use distance learning options or engage in various research and extracurricular activities carried within other study programs that are also facilitated through SaRA.

The structure of courses is as follows:

1. academic - general educational courses - AO (total 8 ESPB - 13.33%)
2. theoretical-methodological courses - TM (total 10 ESPB - 16.67%)
3. scientific-professional courses - NS (total 23 ESPB - 38.33%)
4. vocational-applicative courses - SA (19 ESPB - 31.67%)

## COURSE LIST

### PROGRAMME ENERGY EFFICIENT AND GREEN ARCHITECTURE

#### SEMESTER 1

30 ECTS

- 
- 1 Sustainable Architecture – Green and EE Building Design Principles 5 ECTS
  - 2 Building Physics 5 ECTS
  - 3 Lighting and Energy Efficiency 4 ECTS
  - 4 Thermal Technical Systems and Sustainable Architecture 4 ECTS
  - 5 Energy Efficiency Buildings Certification – Calculations, Verifications and Simulations 5 ECTS
  - 6 Laws and Economic Aspects of Energy Efficient Buildings 3 ECTS
  - 7 Green Building Certification 4 ECTS

#### SEMESTER 2

30 ECTS

- 
- 8 Elective Course #1 3 ECTS  
Green Materials  
Water Management in Buildings
  - 9 Elective Course #2 3 ECTS  
Verification Tools – Measurements and Simulations (of building performance)  
Facility Management
  - 10 Elective Studio 6 ECTS  
Design and Certification of Energy Efficient Buildings – Case Study  
Design for Energy Rehabilitation and Certification of Existing Buildings – Case Study
  - 11 Professional Practice 3 ECTS  
**Final Thesis**
  - 12 Thesis Research 5 ECTS
  - 13 Thesis 10 ECTS

#### Learning methods, IT and e-learning

Within the research unit SaRA the study programme foresees utilisation of software for energy simulations and life cycle assessments, as well as of on-line connectivity software for organisation or attendance to the virtual lectures of guest lecturers from other higher education institutions in the country and abroad, that is, the lecturers from commerce and

other sectors. The programme also implies the use of an existing electronic platform at the University of Belgrade – Faculty of Architecture, which serves to accommodate teaching and learning materials, and is available to teachers, associates and students. There is also an opportunity for the candidates to be introduced to various methods of verification, such as thermovision surveys, air tightness test and other latest techniques and tools in the area of energy-efficient and green constructions. The collection of published material, developed within the project KLABS according to the content and needs of study programme, entitled **Reviews of Sustainability and Resilience of the Built Environment for Education, Research and Design (TU Delft Open, 2018)**, is available to students in electronic format through open access. The other relevant publications, research material and tools are available at the Energy Efficiency Hub (<http://eeplatforma.arh.bg.ac.rs>) which was developed in cooperation with non-academic sector.

### **Learner-centred approach**

The programme “Energy Efficient and Green Architecture” implements the “learner-centred approach” through the definition of flexible learning paths based on learning outcomes and provided through a large number of elective courses, where the students are offered the possibility to select topics according to their own profession, interests and plans for future career development. The percentage of elective courses in the study program is 50.00%.

### **Integration of research with education**

Specialist academic programme “Energy Efficient and Green Architecture” gradually guide students into different methods of research work and provides them the methods and skills necessary for high quality research output. Through the work on specific topics and tasks in different courses, the students master the methodology of research and methods of linking research with practical work, thus qualifying for solving real problems in the professional work or for continuing education at doctoral academic studies in the country or abroad. The final theses is, in fact, the result of an individual research and all volumes remain available as the material for further research as well as practical guidelines for certain challenges of contemporary practice in the field of energy efficient and green architecture.

During the specialized studies, the linking of theoretical and practical knowledge takes place both in the process of architectural design and in the process of calculating and verifying the energy and environmental performance of buildings using appropriate software and equipment. Knowledge that students gain by mastering this study program enables them to act in the latter practice with developed awareness of the total natural resources of the state, which is in accordance with doctrine and principles of sustainable development.

By completing specialized academic studies, students are qualified to design energy efficient and green buildings, participate in the process of managing and organizing the construction of such facilities, as well as to perform their assessment, that is, certification.

## Enrolment

The University of Belgrade – Faculty of Architecture enrolls students in modernised Specialist Programme “Energy Efficient and Green Architecture” from the academic year 2017/2018.

The candidates – foreign citizens - are enrolled within the total number of students envisaged to enrol in programme (32 students’ quota).

The candidates who can apply for specialist programme of academic studies “Energy Efficient and Green Architecture” are as follows:

- candidates with Master in Architecture, Civil Engineering, Mechanical Engineering or Electrical Engineering, i.e., with completed integrated studies according to the article 83, paragraph 5 and 6 of the Statute of the University of Belgrade, with no less than 300 ECTS,
- candidates with the BSc in Architecture, Civil Engineering, Mechanical Engineering and Electrical Engineering, according to the rules applied before the Law on Higher Education came into force.

The order in the list of the candidates who enrol in specialist academic studies is established on the basis of the achievement during the studies (80 point maximum), professional work experience (10 points maximum) and the experience in the field of energy efficient and green architecture (10 points maximum)

When submitting the application, the candidates need the following:

- CV with personal and work experience information,
- Photocopies of Bachelor and Master degree studies (diploma) according to the Law on Higher Education, that is, undergraduate degree according to the laws applied before the Law on Higher Education came into force (original documents to be presented on insight);

## Competencies

The outcome of the learning process is acquiring adequate knowledge, skills and competencies, as well as professional qualifications that enable independent and responsible engagement with the architectural and engineering profession in the area of design, construction, assessment and certification of energy efficient and green buildings, in accordance with national and relevant foreign regulations.

By mastering the study program of specialist academic studies "Energy Efficient and Green Architecture", the student becomes competent to solve real problems from practice, and to continue further education at doctoral or other specialist studies.

General competencies acquired by the student include:

- Mastering the methods, procedures and processes of research in the process of architectural and urban design of energy efficient and green buildings,
- Linking knowledge from specific areas and their application in the integrated solution process,
- Problems of energy efficient and green buildings,
- Developing the ability of critical thinking,
- Ability to analyze problems and solutions synthesis,
- Ability to predict the behavior of the selected engineering solution,
- Ability to present the results of research and design in appropriate and comprehensive way,
- Development of skills and knowledge directly applicable in the design and construction of energy efficient and green buildings,
- Ability of communication and cooperation in team work,
- Development of communication skills and skills in context of the narrower - local and wider -international social environment,
- Ability to understand and to apply innovative tools and methods.

Specific competences acquired through the study program refer to deep and thorough knowledge and understanding of all disciplines of the study program, as well as the ability to solve specific problems using appropriate scientific methods and procedures.

### **Compatibility with regulations, standards, guidelines and good practice**

The programme Energy Efficient and Green Architecture is in line with the European and other international standards and higher education trends (Bologna Principles, European Framework for Quality Assurance in Higher Education, guidelines and results of European projects in the fields of lifelong learning and short-cycle programmes, UNESCO Global Action Programme for Education for Sustainable Development, conclusions of the Council of the European Union on education for sustainable development, Goals of the Agenda 2030 for Sustainable Development, and other), as well as with the justified areas of specialization for engineers from technical-technological field.

The programme is holistic, comprehensive and harmonized with other programmes at the University of Belgrade – Faculty of Architecture, which enables the master engineers of different profiles to directly continue the education and acquire new, advanced knowledge, skills and competencies within the seventh level of the European Qualifications Framework.

The structure and content of the study programme are in line with national regulations in the field of higher education, national standards for technical-technological sciences, Strategy for the Development of Education by 2020, Strategy for Sustainable Development, Strategy for Sustainable Use of Natural Resources and Goods, Law on Efficient Energy Use, as well

as with other regulations and guidelines for the development of higher education according to the most important current needs of society.

In line with the National Strategy for the Development of Education by 2020, elements of research and the contents which encourage entrepreneurship and improve practical skills and competences have been introduced. The scientific-professional and vocational-applicative courses are prevailing, taking 42/60 ECTS (70%). The programme Energy Efficient and Green Architecture is related to the following actions of the Action Plan for the Implementation of the Strategy for the Development of Education by 2020: VO-ZD03; VO-ZD04; VO-ZD06; VO-ZD15; VO-ZD16; VO-ZD18; VO-ZD21; VO-ZD22; VO-ZD23; VO-ZD25; VO-ZD29; VO-ZD30; VO-ZD31; VO-ZD34; VO-AS01; VO-AS06; VO-AS10 and PD-ON07.

New methods, supported by information technologies, were also embodied in the programme, and, through the implementation of the Erasmus + project of the European Commission "Creating the Network of Knowledge Labs for Sustainable and Resilient Environments", the adequate computer equipment, software and library units were acquired. At the same time, through the electronic platform that exists at the University of Belgrade – Faculty of Architecture, the students are provided with open access to learning material, which further modernizes the education process.



# FIRE PROTECTION

## Professional Specialist Programme

Higher Technical Professional School in Zvečan

One-year (60 ECTS) study programme of specialist professional studies “Fire Protection” at the Higher Technical Professional School in Zvečan was developed within the Erasmus+ capacity building project in the field of higher education entitled “Creating the Network of Knowledge Labs for Sustainable and Resilient Environments – KLABS”.

The main objective of study programme “Fire Protection” is to educate **specialist vocational engineers for protection from catastrophic events and fire** with specific competencies in the field of fire protection engineering and the ability to apply acquired scientific and professional knowledge while solving problems related to fire protection, and management and development of modern fire protection systems.

Specific programme objectives refer to the acquisition of theoretical knowledge and practical skills that are needed for:

- Identification of hazards and risks of fire in the workplace;
- Analysis of technological processes in terms of implementation of measures for protection against fire and explosion;
- Engineering calculations of combustion process with regard to stoichiometric and thermodynamic problems;
- Identification and analysis of risks and protection against fire and explosion caused by the effects of electricity;
- Design and maintenance of fire alarms and firefighting systems;
- Organization and managing the fire protection systems;
- Organization and management of interventions, rescue, evacuation and rehabilitation from fire and explosions;
- Fire and explosion expertise;

- Project management and application of project management principles in the field of fire protection;
- Development and implementation of methodologies, methods, tools and procedures in the management of fire and explosion;
- Application of information technology in fire protection engineering;
- Management and development of human resources in fire protection systems;
- Critical evaluation of current problems of fire protection and the characteristics of their research and solving;
- Innovative professional approaches and teamwork;
- Continuing education and the knowledge development in the field of fire protection.

## Curriculum

COURSE LIST

### PROGRAMME FIRE PROTECTION

#### SEMESTER 1

30 ECTS

- 
- |     |   |
|-----|---|
| 1   | Fire Dynamics 8 ECTS  |
| 2   | Designing and Maintaining Fire Alarm Systems 8 ECTS             |
| 3   | Fire Protection System Inspection, Testing and Servicing 8 ECTS |
| 4   | Elective Course 6 ECTS  |
| 4.1 | Fire Protection Reengineering                                   |
| 4.2 | Estimates of Damage, Premiums and Insurance                     |

#### SEMESTER 2

30 ECTS

- 
- |     |   |
|-----|---|
| 5   | Electrical Safety Installations with a Fire-Resistant System 5 ECTS |
| 6   | Risk Management and Risk Assessment Methods 5 ECTS                  |
| 7   | Professional Practice 5 ECTS  |
| 8   | Professional Thesis 10 ECTS   |
| 9   | Elective Course 5 ECTS  |
| 9.1 | Health and Psychological Measures for Protection of Fire            |
| 9.2 | Emergency Management  |

Study program is organized through mandatory and elective courses. Mandatory courses cover basic specialist knowledge, while electives provide specific knowledge of interest to a student.

Professional thesis foresees independent professional research work. Through the work on specific topics and tasks in other programme courses, students master the methods of

linking research with practical work, which qualifies them to solve real problems in professional work or to continue their education.

The course Professional Practice includes 90 hours professional program, collaboration with assigned external mentor, and knowledge assessment carried out by responsible teacher from the School during the defence of a written student's work developed in accordance with the executed practice. Conditions of performing the professional practice are defined by institutional rulebook and the national recommendations based on European guidelines. Professional practice is carried out in institutions and other organizations that are directly or indirectly connected with the study programs of the Higher Technical Professional School in Zvečan and with which the School has signed business and technical cooperation agreements, or in the laboratories that develop corresponding technologies and products. Professional practice can also be carried out in an organization in which the student is employed, if it is in accordance with the program of professional practice.

### **Learning methods, IT and e-learning**

The second-level Specialist Professional Programme "Fire Protection" was modernised in the framework of the Erasmus+ project "Creating the Knowledge Labs for Sustainable and Resilient Environments - KLABS". The innovation of existing programme encompassed upgrade of learning methodology, introduction of new courses and the establishment of the **Centre for Training and Fire Protection Services** consisted of two laboratories - **Laboratory for Examination and Maintenance of Fire Extinguishers** and **Laboratory for Alarm Systems Design**.

Work in the Centre for Training and Fire Protection Services teaches students how to apply the knowledge acquired in other programme courses or during the first-cycle studies. Training in the Centre prepares students to respond to new fire protection-related problems that permanently arise in the built environment, and to find sustainable solutions for accumulated existing problems in industry and economy.

Programme implies the use of existing electronic platform at the Higher Technical Professional School in Zvečan, to accommodate teaching and learning materials. **Volume 5** of the collection of books developed within the project KLABS – **Reviews of Sustainability and Resilience of the Built Environment for Education, Research and Design (TU Delft Open, 2018)** – elaborates different topics encompassed by study programme and is available to students in electronic format through open access.

### **Enrolment**

Higher Technical Professional School in Zvečan enrolls students in modernised programme "Fire Protection" from the school year 2017/2018.

The access to study programme is given to a person who achieved at least 180 ECTS during the previous education, i.e. a person who completed three-year professional education in the field of technical-technological sciences and belonging areas corresponding to programme character – Mechanical Engineering, Electrical Engineering, and Technological Engineering.

The admission of candidates begins after public announcement. Students' quota is determined by the institution and according to the Decision on Programme Accreditation. Ranking list is formed according to the average grade achieved during bachelor vocational studies.

Foreign citizens may enrol in Specialist Professional Programme "Fire Protection" under same conditions as national citizens, within the total envisaged number of students.

## Competencies

The education at Specialist Professional Programme "Fire Protection" provides **general ability** for:

- Analysis of fire-related problems in the working and living environments;
- Prediction of solutions and consequences;
- Application of methods, procedures and processes of identification and assessment of risks in the working environment and living environments;
- Development of critical thinking and approaches in solving current problems in the field of fire protection;
- Application of knowledge in practice;
- Development of competences and skills of professional communication with various actors and members of wider environment;
- Acting in line with professional ethics.

In addition, the programme provides **subject-specific skills and professional competences** for:

- Assessment of risks from fire and explosion;
- Supervision in the field of fire and explosion;
- Preparation of reports on the status of fire and explosion;
- Preparation of plans and technical documents in the field of fire and explosion;
- Design of specific fire alarms, and surveillance and firefighting systems;
- Organization and management of interventions, rescue, evacuation and rehabilitation of fire and explosion;
- Expertise in the field of fire and explosion;

- Education and knowledge management in the field of fire and explosion;
- Drafting normative acts in the field of fire and explosion;
- Organization of the system of fire protection, and optimization and management of available resources;
- Development of methods and procedures for fire protection system management;
- Development of methods for assessing the effectiveness of fire protection systems;
- Project management and innovation in the system of fire protection;
- Innovation activities and teamwork in emergency management;
- Management activities, maintenance of facilities, installations and equipment;
- Preparation and participation in comprehensive workplace risk assessment;
- Organizing and managing the system of health and safety at work in organizations;
- Education and training of employees in safety and health at work.

### **Compatibility with regulations, standards, guidelines and good practice**

The content of study programme “Fire Protection” enables students to acquire knowledge from natural, technological and medical sciences, and humanities, as well as the skills and competencies necessary for work on complex fire protection-related problems. Programme offers acquisition of contemporary theoretical knowledge and practical skills, development of ability for independent and creative professional work, as well as the ability for teamwork and professional collaboration with various actors. In the state of rapid technological development that brings prosperity but also potential hazards and risks of fire, programme deals with the education of specialist professional engineers who can identify and propose ways to reduce potential hazards and fire risks in the workplace and to ensure safer living conditions. Bearing in mind the social, economic and broader social importance of fire safety, the experts of this profile have socially justified and useful skills.

The programme is in line with the European and other international standards and higher education trends (Bologna Principles, European Framework for Quality Assurance in Higher Education, guidelines and results of European projects), as well as with the justified areas of specialization for engineers from technical-technological field. The programme is adjusted to national regulations in the field of higher education, national standards for technical-technological field of science, national Strategy for the Development of Education by 2020, and other regulations and guidelines for the development of higher education.