WBCInno

Catalogue on Research and Innovation Potential of the University of Zenica

Zenica, February 2014

Catalogue on Research and Innovation Potential of the University of Zenica

Realisation: University of Zenica
Entrepreneurship and Innovation Center

Sponsored by:

Tempus

Zenica, February 2014

Impressum

Publisher
University of Zenica, WBCInno project
Entrepreneurship and Innovation Center, EIC UNZE
Fakultetska 3
72000 Zenica
Bosnia & Herzegovina

For publisher
Prof. Dr. Sc. Dževad Zečić

Editor
Prof. Dr. Sc. Darko Petković

Graphic design
Nenad Veljković
Milan Kostadinović

Printing

Copies

Zenica, February 2014

ISBN

Preface

The University of Zenica, and its Entrepreneurship and Innovation Center together with sixteen partners from Europe and the Western Balkans region, started the implementation of the TEMPUS project WBCInno, entitled "Modernization of WBC universities through strengthening of structures and services for knowledge transfer, research and innovation" in October 2012. One of the project objectives is the development of Regional university innovation platform, preceded by mapping of the research and innovation potential at five universities from the Region participating in the project (University of Kragujevac, University of Novi Sad, University of Montenegro, University of Banja Luka and University of Zenica).

The first step was development of the mapping methodology and appropriate questionnaire with well-structured sections and questions that enabled collection of data on research infrastructure, laboratories, centres, research teams with significant results and innovation potential. The aim was also to collect the information on valuable research results, developed technologies, software, patents and licences, specific methodologies, trainings, commercial services, laboratory tests that can be commercialized and offered to the users outside the university, primarily from enterprises in the Region. Besides the review of some mapping results in this printed version of the Catalogue, its electronic (HTML) version is also being developed which will allow the continuous input of collected data, management and generation of specific reports in order to monitor the research and innovative activities at the university. Also, the Catalogue will enable the database search against various criteria by external users as well as easier linking of the interest groups (researchers, enterprises, innovators, investors, etc.) that encourage the commercialization of research results and innovations on the market.

The first chapter of Catalogue is an introduction to the University of Zenica. The second chapter represents the core of the Catalogue and gives the uniform presentation of Entrepreneurship and Innovation Center and other centres, laboratories and research teams at the University of Zenica, through overview of their activities, results, resources, international/national projects and projects with the industry, most significant references, developed prototypes, patents and other measurable research results that have commercial and innovative potential.

The intention is to publish the printed versions of the Catalogue annually, and this edition presents centres, laboratories and research teams that joined this initiative from the beginning and delivered necessary information by filling in the questionnaire for the quality overview of their potential. Indisputably, the continuous mapping of research results in the following period will result in identification and presentation of other research groups at the University, which will in the long term allow better application of research results, knowledge transfer and development of innovative region.

On behalf of the WBCInno Consortium, we would like to thank to all of our colleagues who prepared high quality material for presentation of their teams' activities and results in this Catalogue.

In Zenica, February 2014

UNZE Project team:
Prof. Dr. Sc. Darko Petković
Dr. Sc. Malik Čabaravdić, Asst. Prof.
Dr. Sc. Hasan Avdušinović, Asst. Prof.
Mirza Oruč, MA
Ibrahim Plančić, Mr. Sc.
Lamija Subašić, prof.

Content

University of Zenica

Basic data about the UNZE

Full name: UNIVERSITY OF ZENICA – UNIVERSITAS STUDIORUM ZENICAENSIS UNIVERSITY OF ZENICA

Address: FAKULTETSKA 3
72 000 ZENICA
BOSNIA AND HEREZEGOVINA

Phone: + 387 32 444 430
+ 387 32 444 420
Fax: + 387 32 444 431

Website: www.unze.ba

Type: PUBLIC INSTITUTION

Number of students: 5.364 (4.164 FIRST CYCLE + 1.150 SECOND CYCLE + 50 PhD CANDIDATES)

Number of teaching staff: 460 (132 FULL-TIME EMPLOYED FACULTY STAFF + 103 DOUBLE EMPLOYED STAFF WITH THE ZF + 225 GUESTS)

Number of full-time employed staff: 349

Total surface area of premises: 40.000 m2

Official e-mail address: rektorat@unze.ba

History of the UNZE

Since the late seventies of the last century, there has always been a wish, in various intensity and in various shape expressed, for establishing of a University of Zenica (UNZE). But, sadly, there has always been one reason more against it! Efforts of a large group of people, done more than ten years ago, finally paid back, and the decision on founding of the University of Zenica was reached by Zenica-Doboj Canton Assembly. However, various events and activities, both positive and negative, followed this phase of establishing the University of Zenica, but they had no influence on final outcome or willingness of the founder, e.g. Government and Assembly of Zenica-Doboj Canton, and on the 18th October 2000, the decision on establishing of the University of Zenica was made.

It is necessary to emphasize that faculties in Zenica were opened at the same time, when already developed university centers in Bosnia and Herzegovina, e.g. Banja Luka, Mostar and Tuzla, opened their first faculties. But, in the 70's of the last century, the mentioned centers did a big step forward and they established universities. Zenica made this step more than 20 years later. It is our belief that this unnatural delay will be compensated. We based it on the results of the University of Zenica, accomplished in only 6-7 years of its official work. It has to be pointed out that resistance to the beginning of work of the University of Zenica lasted from 2000 to 2004. Establishing of the University was even prohibited by the Office of the High Representative (OHR) in Bosnia and Herzegovina, an unprecedented act in the area of higher education in the EU or the world. So, the UNZE had to wait, while other universities had many opportunities to grow, develop and participate in the EU projects.

Therefore, the University of Zenica represents the success of more than 50-year old higher education tradition in Zenica, and in 2010 a small jubilee was celebrated - it was the 10th anniversary of the historic decision of Zenica-Doboj Canton Assembly on establishing the University. This decision is a logical and natural sequence in the development of higher education and scientific and research work in Zenica. A multitude of university activities, in academic sense and in R&D work, work of management of member faculties, as well as the Rector's Office activities completely justify this decision on establishing the University, and they prove the University of Zenica has the capacity to generate the development in the region of Central Bosnia.

If we take into consideration these facts: the University of Zenica started to function as an institution in 2004; in 2005, the Faculty of Metallurgy and Materials, the Faculty of Mechanical Engineering and the Faculty of Education acted in the capacity of legal persons; and in 2006, the fuli integration of member faculties started, then we can come to the conclusion that the University has been working in its full capacity for 6-7 years.

It can be concluded that the number of academic staff and material & technical resources (premises, equipment, etc.) were pretty good for the beginning of work of the UNZE, but it is also a fact that predication and plans from that period contained many parameters, for which was expected to have a greater growth than the one accomplished up to today. In some elements (number of departments, innovations and R&D equipment, number of students), goals were reached, but, sadly, in numerous other elements, there occured delay or stagnation (a budget growth, modest and outdated premises for teaching, insufficient surface area in square meters of premises, stagnation in development and in number of human resources).

In accordance with the mentioned above, the UNZE created and built a flexible and effective organization, enabled to react to demands and needs of direct and indirect environment, and in that way to serve as a support to the society and as a promotor of new ideas and concepts. The UNZE must not and can not be a taylor-type organization, oriented to the mass production of large number of identical units.

On the contrary, the UNZE is meant to be an organization for nurturing individual diversity and skills, and to survive thanks to development of the greatest resource - its human potential, students and employed staff.

The university autonomy is the main prerequisite for successful work of the University, and it is founded on this principle: "The university is an autonomous institution at the heart of societies differently organized because of geography and historical heritage; it produces, examines, appraises and hands down culture by research and teaching. To meet the needs of the world around it, its research and teaching must be morally and intellectually independent of political authority and intellectually independent of political authority and economic power."

Reaching political and economic independence is a very hard thing to do, not only in the circumstances of Bosnia and Herzegovina, but, also, in many other countries. So, the UNZE has to promote its mission and vision, and has to do everything necessary to ensure itself, as a newly founded institution, to have the power, right and full responsibility for its development.

On the 1st January 2006, the UNZE started to work as a fully integrated university with single legal subjectivity entrusted only to the University, not to its member faculties. It is possible to obtain an academic degree in accordance with the study system (4+1+3) or the study system (3+2+3) years, what depends on a faculty (department). In accordance with the European recommendations, ali subjects of curriculums last one semester, and all subjects were designed under ECTS rules.

Organization of the UNZE

Almost every well-established university in the world respects strict rules, defined in the university statutes, and the UNZE makes no exception to this rule. When we think of the organization of the UNZE, at the first place comes the legal aspect that regulates this organization, e.g. Framework law on higher education in B&H, Law on higher education in ZDC and, finally, the Statutes of the UNZE. The articles of the Statutes, directly or indirectly imply the organization of the UNZE, will be reffered to: Article 3 - Basic guidelines and goals of the University of Zenica; Article 4 - Power of the University; Article 6 - Inviolability of the University premises; Article 8 - Responsibility of the University; Article 9 - Language and right to higher education; Article 10 - Academic freedom and autonomy of the University; Article 11 - Freedom of the University; Article 12 - Autonomy of the University; (in the Chapter III - a legal entity) Article 13 - Name and location of the University; Article 14 -Right to representation; Article 15 - Rights and duties of the Founder; Article 16 - Report on Operations of the University; Article 17 - Sign of the University; Article 18 - Stamp of the Unviersity and Organisational Units; Article 19 - Joining of the University; Article 20 - Register of the Municipal Court in Zenica; Article 21 - Statutory changes; (CHAPTER IV. ACTIVITIES OF THE UNIVERSITY); Article 22 - Activities of the University; Article 23 - Work Programm of the University (PART II - ORGANISATION OF THE UNIVERSITY - CHAPTER I. ORGANISATIONAL UNITS AND ASSOCIATED MEMBERS); Article 24 - Conditionality of the University organisation; Article 25 - Internal organisational structure of the University and types of organisational units; Article 26 - Definitions of the organisational units; Article 27 - Rector's Office of the University; Article 28 - Organisational units of the University; Article 29 - Establishing, dividing, merging and eliminating the organisational units; Article 30 - Acting of organisational units in legal representation; Article 33 - Autonomy and authorization of the organisational units; Article 34 - Suborganisational units of the organisational units; Article 35 - The University as a founder of scientific organisations/institutions; Article 36

- Jurisdiction of faculties and their parts in the frame of the University); Article 37 - The authorization of organisational units in the field of scientific-research work and constant professional specialization; Article 38

- Types of scientific-research and professional work of the organisational units, and many other articles that clearly and plainly „define the rules of work" of ali partners in the process of higher education and scientific-research work.

The public institution University of Zenica is organised and works as one legal subject, and it contains organisational units: faculties, institutes and centers. Faculties contain the core chairs, uniformed for the entire university, and this avoids scientific dualism and enables scientific uniformity in accordance to the Frascati criteria, and recommendation of the UNESCO and UNIDO.

The contemporar and dynamic organisational structure recognises institutes in the frame of the faculties (e.g. Mechanical Engineering Institute of the MF or Institute of Economics at the EF), centers in the frame of universities or faculties (e.g. Entrepreneurship and Innovation Center, Center of interreligious studies of the UNZE or Center of management, quality and development of the MF). The integrated chairs are very important in implementation of teaching and scientific-research process; they are starting points and basic units in regard to scientific and professional promotions and elections for the positions, key process implementation on the faculties and the University.

The University is lead by a Rector, who is in his/her work helped by 4 vice-rectors (vice-rector for financing and development, vice-rector for student affairs and teaching process, vice-rector for scientific-research work, vice-rector for international cooperation and quality assurance). Rector and vice-rector are elected for the period of 4 years through the public call, opened for teachers outside the UNZE, who also have an adequate academic rank.

In certain affairs, a rector is also helped by the secretary general and the Office of legal affairs.

The UNZE Senat is the most important academic and professional body of the UNZE, chaired by the elected president of the Senate, who belongs to the teaching staff of a faculty and who is delegated by a faculty in accordance with the Rulebook on work of the Senate. Members of the Senate represent all faculties (dean + 1 elected representative), institutes and centers, there are also a rector and vice-rectors, and representatives of the students of all study cycles (min. 15% of total number of members).

The UNZE Steering Board is the highest governance body of the university (Article 48 of the UNZE Statute), and it has 7 members, who are representatives of the academic and non-academic staff, students and the Founder. A procedure for election and appoinment of a president and members of the Steering Board is iniciated simultaneously by the Senate and the Canton Government, and at least 6 (six) months befor the mandate of the current members of the Steering Board expires. The Senate determines general and specific criteria for appointments of the Steering Comittee members, elected from the academic staff of the University, and a member, who will be elected among students of the UNZE. If the above mentioned critera are established, the Senate makes a decision on a contest announcement and appoints a committee for selecting members (further: Committee for OU) of the academic staff of the University and for a member among students, who will be the appointed members of the Steering Board. There will be 5 (five) members, and someone will be appointed as a president and someone as a vice-president. Rules of work, duties and responsibilities are clearly set in the Statute of the UNZE. There is the UNZE Student Union; it is a top organization for gathering and organizing students of the University of Zenica and it coordinates the work of student organizations on the faculties. The student union is chaired by a president of the union, who is also a member of the UNZE Senat.

An important element of the UNZE work is the Quality Comittee, consisted of a QA manager of the UNZE and QA managers of the organisational units, and it is lead by a vice-rector of quality assurance and international cooperation. The Quality Comittee contains: Office of ECTAS and there is a manager of ECTAS; Office of competence and career development and there is a manager of competence; Office for work with the special need persons and there is a manager for this office. An important link for the work of the Quality Comittee is the Stakeholder Forum of the UNZE, a permanent body of 23 external and 8 internal permanent members.

Also, the UNZE structure has other bodies and units, and their place, role, significance and responsibilities are clearly defined, e.g. Student Center, Ethics Comittee, various commissions, etc.

Today UNZE has 9 organisational units as permanent members and 1 unit as associate member:

- Faculty of Metallurgy and Materials Science,
- Faculty of Mechanical Engineering,
- Faculty of Philosophy,
- Faculty of Economics,
- Faculty of Law,
- Faculty of Health Care,
- Faculty of Polytechnic,
- Institute of Metallurgy "Kemal Kapetanović",
- Student Center,
- Islamic Pedagogical Faculty (the associate member).

Sub-organization units of the UNZE are:

- Center for Social and Interreligious Research
- Center for Legal Global Understanding
- Entrepreneurship and Innovation Center
- Institute of Economics of the Faculty of Economics
- Institute of Mechanical Engineering of the Faculty of Mechanical Engineering

APPLICATION OF THE BOLOGNA PROCESS AT THE UNZE

General elements of the Bologna Process

In the university circles, and even broader, the most frequently used term is the Bologna Declaration or, more specific, the Bologna Process. The Bologna Process was officialy started on the 19th of June 1999 by the Bologna Declaration, and it was based on many documents and declarations, e.g. the Magna Charta Universitatum, which stated basic principles of the university founding, developing and operating, than Lisbon Convention, Sorbon Convention, Bologna Declaration, Salamanca Convention, Prague and Berlin Communiqué, and Ministry Conference in Bucharest (Romania), held in May 2012.
The Bologna Process essence was stated in the declaration which proclaimed the European higher education area (EHEA) and its establishment up to 2010. Only this organized European higher education system can accomplish the synergy effect and can enable a higher level of competitiveness, in economic and in cultural and educational field.

Assessment of the application of the specific elements of the Bologna Process

The implementation of the Bologna Process at the UNZE includes:

- **Adoption of a system of easy understandable and comparable academic titles;**

....this is a problem that has been an unsolved equation for the public universities in B&H for many years. The University of Zenica and other six public universities in B&H (Tuzla, East Mostar, East Sarajevo, Banja Luka and Bihać) harmonized the titles of degrees obtained after graduation.

The education system at the University of Zenica is large!y adapted to the needs of the labour market and the possibility of the students to attend to ali three study cycles. The UNZE applies both concepts, e.g. 4+1+3 and 3+2+3, but it has to be said that the first concept is more focused on academic and the other on professional education. Curriculums have to be periodically inovated and they provide the acquisition of adequate knowledge, skills and competence, ali expressed through the learning outcomes. The adopted and implemented documentation system (learning agreement, transcript of records, diploma supplement, etc.) contain the documents that support a system of easy understandable and comparable academic titles. Above mentioned documents are adopted by the adequate bodies of the UNZE (e.g. Senate), on the basis of concensus with the founder (the Government of ZDC), and they are issued in a bilingual version (BCS languages and English language).

• **Adoption of a system with three main cycles (graduate / master / PhD);**

... was implemented in the system of 4+1+3 years (240+60+180 ECTS) and 3+2+3 years (180+120+180 ECTS). The UNZE has already organized postgraduate/master study in accordance with the concept of 4+1 as well, an at the end of 2011, ali preparations were done for the beginning of the second generation of master study (II cycle). The doctoral studies, in accordance with the Bologna Concept, are still in preparation and, for now, the doctoral dissertations in this transitional period are done on the UNZE as research projects in accordance with the old system. The registration process of doctoral dissertation in accordance with the old system is legally finished on the 30th December 2013 and today there are on the UNZE more than 50 candidates on 8 OUs working on their doctoral dissertations (a survey of doctoral dissertations, mentors, candidates, etc. can be found on the UNZE website, in the section: Science).

• **Establishment of the European Credit Transfer and Accumulation System – ECTAS;**

This system is consistently implemented on all the OUs/faculties of the University, in an unified way for the whole University. The basis for the calculation was the working standard of 1800 h/year for students, and it gave the relationship of 30 hours of student work = 1 ECTS. ECTAS coordinators work with the Vice-rector of teaching and Vice-deans on establishing more accurate correlation between the ratio of ECTAS and the volume of literature that students use for exam preparation, and also other researches were done on actual student workload and the number of ECTAS (e.g. student workload). There were made corrections of ECTAS, where the practice showed that they were not adequately evaluated.

• **Promotion of mobility by removing the obstacles to the efective implementation of fully free movement of students, teachers, assistants and administrative staff;**

This component of Bologna Process is maximally promoted at the UNZE, and the largest number of administrative obstacles to its application has been removed. All the required documentation exists and it has been adopted by the Senate. On our website is available the UNZE Information Package in BCS and English languages, and in 2013, a new version of this Package was made by the Office of international cooperation. In accordance with the Rules of studying and the UNZE Statute, during the study, a student has the right to spend a period of time (semester or a study year) on another HEI in the country or abroad, via international student exchange programmes or on the basis of bilateral agreements between universities. In accordance with an agreement, which will be signed by a student and by an University, the number of gained credits will be recognized. Students and teachers of the UNZE participate in various summer schools, organized by the partner universities (Istanbul, Kopar, Resica Network, Erasmus Mundus, Erasmus Plus etc.) and the passed exams and ECTAS are recognized by the UNZE. In the future, our focus has to be put on projects of Erasmus Plus Programme and applications, which will enable greater student mobility, e.g. a goal is minimally 15 ECTAS to be gained from mobility or 3 months continuously to be spent on a foreign institution. In this way, the UNZE would manage to comply with the declared objectives for European mobility to 2020. Also, there has to be organized an intensive language training and teaching for teaching staff, and especially the use of foreign languages has to be focused on, while it is asked for in the mobility programmes.

- **Promotion of the European dimension in higher education, etc.**

It is most directly worked on this principle through the developed international cooperation. This cooperation includes: study visits, exchanges, work on diploma papers, master and doctoral dissertations, joint projects, etc. The UNZE actively cooperates with the foreign embassies in B&H, and with the B&H embassies in the world. Many protocols on cooperation were signed, many new international projects started, many applications to the Tempus Programme were submitted, many study visits were made by the teaching staff and by the students as well (to the universities in Graz, Porto, Brussels, Maribor, Ljubljana, Girona, Skopje, Podgorica, Belgrade, etc. and our students participated in trainings in Brašov, Porto, Koper, Tirana, Podgorica, Ghent, Brussels, etc.)

- **Life-long learning;**

Through cooperation with local and foreign partners, the UNZE would like to raise this important area of education to a higher level, and it is a task on which the UNZE will work persistently in the coming years. The current system of lifelong learning has its forms, which treat the organization of certain additional education trainings on the faculties, it deals with the process of acquiring additional qua!ifications, knowledge, skills and competence, etc., but there is no clear definition and strategic concept of this study. On certain faculties (e.g. Faculty of Philosophy, Faculty of Health, etc.), the programmes (curriculums) of various forms of life-long learning with ECTAS were made. A special emphasis in those lifelong learning programmes was put on additional education programmes for certain qualifications, e.g. pedagogy for vocational teachers in high schools (mostly attended by the engineers), training in various pedagogy disciplines for younger teaching staff, etc.

- **Involvement of the students in all areas of work of HEIs;**

Institutionally, students are involved through their representatives in the work of the teaching-scientific boards of the faculties, the UNZE Senate, the Quality Board and the Stakeholder Forum, and they have an equal right to discuss, vote and decide. Students have their own Union, and the UNZE management does not want to control the work of this Union.

- **Improving attractiveness and competitiveness of European Higher Education Area in other parts of the world;**

As a part of unified European Higher Education Area (EHEA), the UNZE is investing a maximal effort to comply with all the positive elements in it, and the best confirmation of this is a large number of UNZE graduates (more than several hundreds graduates of the faculties of Zenica), who work in their professions in EU countries and around the world (USA, Canada, Australia etc.). Every information obtained from foreign embassies, ministries, universities, foreign competitions, etc. is as soon as possible put on the website of the University of Zenica and on bulletin boards of the OUs (sections: scholarships, competitions, news etc.).

- **Social dimension of studying and equal access for all;**

The UNZE is very sensible and has a clear acceptance of social dimension of studying today in B&H, and, therefore, charges the smallest fees to the students who have to pay them. Students, who are supported by the public financing, have to pay for admission material, but by the cheapest prices. Generally, the admission documents and other expences are 2-3 times cheaper than on the other public universities in B&H, and due to this, today the UNZE collects the smallest incomes from this source than any other public university. All students, with no regard to the sex, race, nationality or religion are provided with the same opportunities of admiting and studying. An intensive work has been done on securing a complete system of access to study for the persons with special needs.

The elements of the Bologna Process (duration of a study, organization of I, II and III cycle, student mobility and staff mobility, ECTAS, Diploma Supplement, Life-long Learning, etc.) are clearly defined by the articles of the UNZE Statute, and therefore, there is no improvisation or arbitrary interpretation on what and how something is done in the frame of the Bologna Process. The UNZE has the representative in the Bologna Committee of B&H and in the Expert Team for Bologna Process in the EU, and every new solution in this process is clearly accepted and has its place in the work of the UNZE.

SCIENTIFIC & RESEARCH WORK

R&D and professional projects

Scientific & research (or research & development) and professional work of the UNZE is one of the most important links in the work of the UNZE.

The UNZE is one of the leaders in B&H in regard to the number of international R&D projects, done in previous years, and a special emphasis can be put on:

A RAPID MAKING OF TOOLS AND PRODUCTS OUT OF POLYMER MATERIALS - International project with the University of Ljubljana - Slovenia; Founded by the Government of Slovenia. Partner: the Faculty of Mechanical Engineering of the UNZE.

CENTER OF WOOD EXCELLENCE - STRENGTHENING OF RESEARCH, DEVELOPMENT AND TRAINING CAPACITIES; WOOD INDUSTRY, BOSNIA & HERZEGOVINA; Project Holder: the University of Bern (Switzerland) and the Government of Switzerland - Partner: the Faculty of Mechanical Engineering of the UNZE.

DEVELOPMENT OF MANAGERIAL COMPETENCE; Application for Flanders Government; Belgium, 2007 (with the University KHL Ghent), Partner the EF of the UNZE and EIC UNZE

DEVELOPMENT OF INNOVATION CENTRES IN ZENICA, MOSTAR AND BANJA LUKA; the Entrepreneurship and Innovation Centre in Zenica; IPA 2009 (Instrument for Pre-Accesion Assistance - Council Regulation EC No. 1085/2006 - OJ L 210/82 of 31. 07. 2006.)

STABLISHING OF THE INSTITUTE OF MATERIALS IN SUDAN, International project with the Institute of Materials in Sudan - Sudan, 2010 - Founded by the Government of Sudan.

TRANSFER OF KNOWLEDGE AND EXPERIENCE FOR CREATING ADEQUATE METROLOGY INFRASTRUCTURE AND THE PRACTICE OF NATIONAL LABORATORY OF PHYSICAL UNIT FOR PRESSURE IN REGARD TO THE SPECIFIC NEEDS OF ECONOMY IN B&H, International project of the bilateral cooperation between B&H and the Republic of Slovenia, 2007-2008, Funded by the Government of Slovenia and the Federal Government of B&H. Partner: Institute of Metallurgy "Kemal Kapetanović" of the UNZE.

THE APPLICATION OF NEW MATERIALS IN AUTOMOTIVE INDUSTRY, Bilateral project between B&H and Slovenia, Faculty of metallurgy and materials of the UNZE and Faculty of Natural-Technical Sciences (the University of Ljubljana), Project funded by the Ministry of civil affairs of B&H and the Government of the Republic of Slovenia, Period of implementation: 2010 – 2012,

OPTIMIZATION OF THERMAL PROCESSING OF STEEL SEMI-FINISHED PRODUCTS FOR AUTOMOTIVE INDUSTRY, Bilateral project between B&H and Slovenia, (Faculty of Metallurgy and Materials of the UNZE) and (Natural-Technical Sciences, the University of Ljubljana), Project funded by the Ministry of civil affairs of the Government of B&H and the Government of Slovenia, Period of implementation: 2008 – 2010.

FEASIBILITY STUDY ON DEVELOPMENT OF SCIENCE AND TECHNOLOGY PARK IN MONTENEGRO, Podgorica, September 2011. Project holders: the Entrepreneurship and Innovation Center, WUS Graz, Austin Pock Partners Graz, SFG Graz.

NON-PROPORTIONAL SCALING OF METAL CASTING MOULDS; Bilateral project funded by the Ministry of Science of the Federal Government of B&H and the Ministry of Science of the Government of Slovenia; Partner: the Faculty of Mechanical Engineering of the UNZE

GOOD PRACTICE EXAMPLES OF INNOVATION POOL APPROACHES AND INSTRUMENTS OF THE EU MEMBER STATES AND THE WESTERN BALKANS COUNTRIES; Coordination of Research Policies Within the Western Balkans Countries; November 11/15, 2011; WP 8: Innovation Support; Project number: PL 212029; Partner: the EIC of the UNZE

IPA Project: THE ENTREPRENEURIAL EDUCATION IN THE SOUTHEAST EUROPE COUNTRIES (SEECEL - The European Union's IPA Multi-beneficiary Programme - Entrepreneurial learning); Zagreb, July 2011/September 2012. Partner form B&H: the MF and the EIC of the UNZE.

There are numerous projects funded by the Ministry of Science of the Federal Government of B&H (approximately 3-5 on yearly basis) and by the Ministry of civil affairs of the Council of ministers of B&H (approximately 1-2 on yearly basis). Data about these projects are given in detail in the internal evaluations of the OUs, and annual statistical data.

Researches for the master theses and doctoral dissertations

By the definition, researches and works at the level of master and doctoral study imply certain R&D work. Therefore, they have a special place in the R&D structure of every HEI, and as well of the UNZE.

At the moment, there are more than 50 PhD candidates at the 8 OUs of the UNZE, and they are working on doctoral researches. Also, the preparation process for the beginning of doctoral study at ali OUs is on-going. A rulebook on doctoral study organisation was created, and a guidebook of doctoral study is in the process of making.

Published articles

A great attention in implementation of scientific and research work of the UNZE is given to publishing articles at the conferences (congresses, symposiums, etc.), and as well, magazines. More than 80% of these were professional works, and it led to conclusion of the nature of researches (applicative-professional works). On the average, ali OUs approximately published 30-40 works.

Organization of seminars, conferences, congresses, etc.

In the European context, the UNZE has already been recognized as the organizer of the international scientific gatherings (conferences, symposiums, etc.). In the scientific circles of many countries, the UNZE has an excellent reputation for the conferences as TMT - Trends in the development of machinery and associated technologies, Quality and Contemporary Metal and Non-metal Materials - MNM.

In the development visions of the UNZE, there are plans for every OU to have at least one respectable conference annually or biennially, which should increase number of international participants in the future. This implies establishing of partnerships with the foreign universities, having international peer reviews (this is obligatory), publishing various proceedings with an adequate catalogue on regular basis, having an international editorial board, and the bibliographic arrangement as well, and having as much as possible works and conferences completely done and held in English as the official language.

The following conferences as the permanent conferences organized by the UNZE were developed through the previous work:

No.	Conference Title	Organizers	Official languages	Takes place	Proceedings	It was held for the first time in
1.	TMT-Trends in the Development of Machinery and Associated Technologies	MF UNZE UPC Barcelona Uni.Bahcesehir Istanbul	English	Every year	Yes	1994
2.	Quality - Kvalitet	MF UNZE Uni. Erlangen-Nüremberg	B/C/S + English	Every second year	Yes	1997
3.	Održavanje - Maintenance	MF UNZE	B/C/S + English	Every second year	Yes	2010
4.	EMFM-Environmental and Material Flow Management	MF UNZE Uni.Beograd Uni. Trier	English	Every year	Yes	2012
5.	MNM- Metal and Non-metal Materials	FMM UNZE	English	Every second year	Yes	1999
6.	BDC- Business Development Conference	EF UNZE EIC UNZE	B/C/S + English	Every year	Yes	2008
7.	Techno-Educa – Students' Conference	CIP UNZE WUS Austria	B/C/S + English	Every year	Yes	2008
8.	Contemporary Methods of Education	PF UNZE	B/C/S + English	Every year	Yes	2005
9.	Identity and Globalisation	PrF UNZE	B/C/S	Every year	Yes	2009
10.	Jahorina Business Days of Entrepreneurship and Innovation In Tourism- JBD	Uni. East Sarajevo EIC UNZE	B/C/S	Every year	Yes	2012

Mobility of the teaching staff and students

Even before the beginning of the Bologna Process, when the Faculty of Metallurgy and Materials Science and the Faculty of Mechanical Engineering in Zenica were integrated into the University of Sarajevo, one of the most important characteristics of their work was mobility of teaching staff and students. The UNZE continued with this practice. From 2009, this very important segment of work was followed in this kind of reports. Mobility represents participation of teaching staff and students in the teaching or research process at the foreign universities and R&D organisations; during this process, teachers or students take part in implementation of certain teaching, organisational or research activities.

The managements of the UNZE and the OUs have a permanent task to encourage mobility of the teaching staff and students. In this sense, especially significant are projects of Erasmus Mundus Program and CEEPUS Network, in which the UNZE is involved, and there are also bilateral projects with the foreign universities and with the governments of many countries. This cooperation has to be strengthened in the field of research and in terms of work on diploma papers, master theses and doctoral dissertations. The truth is that this cooperation has existed for many years now, even without the Bologna Process, but to a great extent it has not been sorted out systematically. The systematic support and the follow-up of these projects, with the adequate databases on realized visits and results of these visits, are the tasks with which the UNZE tries to adjust the current activities to the requirements for establishing Europe of knowledge. The UNZE tries to achieve a goal of at least 10% mobility of the teaching staff and students.

Entrepreneurship and Innovation Center of the University of Zenica

Contact

Director:
Prof. Dr. Sc. Darko Petković

Email: dpetkovic@mf.unze.ba
Tel: +387 32 444 430,
Fax: +387 32 444 431

Address: Entrepreneurship and Innovation Center
University of Zenica
Fakultetska 3
72000 Zenica

Activity

- Promotion of innovations and entrepreneurship among students and teaching staff,
- Organizing of or participation in organizing conferences, consultancies, internships (workshops), fairs, etc.
- Cooperating role between the University and the job market, related to the creation and development of the new teaching plans and programs,
- Development of innovative and entrepreneurial activity within the student corpus through writing of seminar papers and graduation theses, needed by the economy in the region,
- Assistance in developing research for master and doctoral theses which are needed by the economy in the region and in B&H,
- Promotion of international cooperation on a project and program basis,
- Writing of business plans of interest for the economic development and establishment of innovative companies through development of prototypes,
- Promotion and development of information and communication technologies (IKT) as an important segment of innovation in teaching, scientific and research work,
- Multimedia presentations and seminars with different subjects as an addition to the content of the existing bachelor and master studies,
- Development support programs to the spin-off and spin-out companies within the academic community, and the assistance to the SME region toward stronger business growth and development,
- Assistance in organizing of SME clusters and technology transfer from the developed countries

Important projects

- Tempus; SHEQA - 511262-TEMPUS-1-2010-2012BE-TEMPUS-SMGR (2010-2012); Ka-Ho Saint Lieven University of Ghent; Strategic Management of Higher Education Institutions Based on Integrated Quality Assurance System
- Tempus; 144584-Tempus-1-2008-1-RS-TEMPUS-JPCR 2009-2011; University of Novi Sad; Introduction and Implementation of Academic Program in Comunity Youth Work through Enchancing Regional Cooperation in the countries of Western Balkan.
- Tempus; 158999_Tempus_ES_SMGR; University of Alicante; Strengthening Quality Assurance System within West Balkans HEI's in Support of National and Regional Planning
- Tempus; 145129-Tempus-1-2008-1-BA-TEMPUS-SMSHES; University of Zenica; COMPETENCE: Matching Competences in Higher Education and Economy: from Competence Catalogue to Strategy and Curriculum Development
- Tempus; JEP 41108_2006 ; Politecnico di Torino; Establishment of the Entrepreneurship and Innovation Centre at the University of Zenica

Innovative prototypes / products / services

- Development of scientific-technology parks and the business infrastructure
- Development of the cooperation between the university and enterprises
- Development of the students' entrepreneurship capabilities




Results

- Three conferences held every year (RT JIE 2012 on Jahorina Mountain, BDC 2012 in Zenica and Techno-Educa 2012 in Zenici);
- EIC participated in WBC INCO Project;
- Three projects implemented in partnership with BSC of the Government of ZDC;
- we led the project on entrepreneurial education SEECEL at the Faculty of Mechanical Engineering;
- EIC established many contacts among the labs of the faculties and the business entities,
- we also helped students in regard to performing practices, employment, mobility, participation in the conferences, etc.
- For many years, we have worked on establishing connections with the business entities, and by now it is proved that the issue of cooperation between the university and the business entities is no problem.
- Among our international partners, we can single out these: the Technology Park (TP) of Girona, TP of Barcelona, TP of Torino, TP of Valles, IRI in Ljubljana, Resica Network, etc.
- Also, approximately six months ago, a new faculty, i.e. Faculty of Polytechnics, was established at the University of Zenica, and this faculty directly empowers the entrepreneurial learning at the University; although, every faculty of the UNZE has already adopted a new curriculum on entrepreneurial learning.
- In November of this year, the EIC held the above-mentioned Techno-Educa Conference, titled "With entrepreneurial ideas towards better future", and in 2011, Techno-Educa was titled "Show your competence and create your job".
- EIC participated in a very important project "COMPETENCE - Matching competence in higher education and economy: from competence catalogue to strategy and curriculum development".
- EIC was awarded as the best Tempus project in the EU in area of business binding of the EU universities with the universities from the Balkans.
- EIC also led these projects: TP of Mostar, NTP of Montenegro and Business Zone of Herzegovina, and as well, the project of industrial competence with the University of KaHo Sint-Lieven (Belgium) and VOLVO Cars.
- Many books were published: The technology parks, Guidebook on entrepreneurship, How to start own business; there were also held numerous seminars, training and various contents for the best business plans, start-up competitions, etc.

Resources

Within EIC, there is a Multimedia Center with: 2 LCD TV, modern cameras and microphones, 14 computers + 10 computers located in the Office of competence, LCD projector, equipment for presentations, 100 Mbps optical LAN.

The most important prototypes, products, services, strategies & methodology

Faculties of the University of Zenica held numerous courses and trainings to various groups of employees of public services. Just to name some of them:

- Education of groups of citizens (public service employees) in the field of informal education on environmental protection and sustainable development, in order to strengthen the environmental awareness in Bosnia and Herzegovina.
- Education of teaching staff employed in public services

Developed entrepreneurship/specialized/customized trainings

Entrepreneurship and Innovation Centre of the University participated in Realization of the employee training program for wood processing companies in the Region of Central B&H (jointly with REZ Zenica), together with the Centre of Wood Excellence, for the purpose of the Federal Ministry for Development, Entrepreneurship and Craft (February – March 2008, 60 hour training program), and in a cooperation with Business Service Centre (BSC) of the Cantonal Government participated in the realization of Academy of Entrepreneurship and the Contents of best entrepreneurial ideas.

Presentations of Centres, Laboratories and Research groups

Institute of Metallurgy "Kemal Kapetanović"

- Department for Mechanical Engineering
- Department for Melting and Metal Casting
- Department for Physical Metallurgy - Metallographic Laboratory
- Department for Ore and Iron
- Department for Plastic Processing of Metals
- Department for Physical Metallurgy - Mechanical Laboratory
- Department for Welding
- Department for Protection and Ecology
- Department for Metallurgical Chemistry
- Department for Physical Metallurgy - Physical Laboratory
- Department for Heat Transfer and Measurements

Faculty of Metallurgy and Materials Science

- Laboratory for Sand Casting Properties Investigation
- Laboratory for Chemistry
- Laboratory of Heat Treatment and Metalography
- Laboratory of Non-Metallic Materials

Faculty of Mechanical Engineering

- Laboratory of Technical Diagnostics
- Laboratory of Applied Mechanics
- Laboratory for Metal Cutting and Machine Tools (LORAM)
- Laboratory for Measurements and Automation
- Laboratory for Fluid Mechanics and Hydraulics
- Laboratory for Design and Technology in Wood Processing
- Laboratory for Environmental Monitoring
- Laboratory for Engineering Design LECAD II

Faculty of Economics

- Institute of Economy of the Faculty of Economics

Faculty of Health

- Center for Health Technologies and Innovativeness in Health

Department for Mechanical Engineering

Department of Mechanical Engineering is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Mr. Sc. Mustafa Hadžalić

Email: mustafa.hadzalic@miz.unze.ba
Tel: +387 32 247 999/140
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

- Development of specific engine constitutions and equipment for personal needs.
- Making technical-technological projects and engine documentation for customers and personal needs.
- Engine treatment of different metal parts and components by various procedures.
- Making standard and special spare parts.
- Making standard samples for further needs of laboratory testings.
- Maintenance of personal engine equipment.

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2. M. Hadžalić, D. Vukojević, N. Vukojević: PRILOG ANALIZI DINAMIČKOG PONAŠANJA IZVOZNIH POSTROJENJA PRIMJENOM NUMERIČKIH I EKSPERIMENTALNIH METODA, 7. Naučno-stručni skup sa međunarodnim učešćem KVALITET 2011 Neum, B&H, 01.-04. juna 2011.
3. N. Vukojević, F. Hadžikadunić, M. Hadžalić, M. Terzić: OCJENA DINAMIČKOG PONAŠANJA STRUKTURE IZVOZNOG KOŠA, 1st International Scientific Conference on Engineering, Manufacturing and Advanced Technologies, MAT 2010, Mostar, 2010.
4. D. Vukojević, E. Ekinović, M. Hadžalić: THE INFLUENCE OF TECHNOLOGICAL PARAMETERS ON MINE HOISTING CASE IN DYNAMIC CONDITIONS, 14th International Research/Expert Conference "Trends in the Development of Machinery and Associated Tehnology" TMT 2010, Mediterranean Cruise, 2010.
5. Univerzitet u Zenici, Metalurški institut „Kemal Kapetanović" Zenica, naslov projekta PROIZVODNJA POLUFABRIKATA OD AUSTENITNOG NERĐAJUĆEG ČELIKA NITRONIC 60 i SUPERLEGURE NIMONIC 80A, broj E-1533, studija izvodljivosti, 2008.

Department for Melting and Metal Casting

Department for Melting and Metal Casting is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Mr. Sc. Derviš Mujagić

Email: dervis.mujagic@miz.unze.ba
Tel: +387 32 247 999
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

The primary activity of this Department is scientific and research work in the field of metallurgy of metallic materials that make development and applied research in order to improve the basic characteristics of alloys based on iron, nickel, cobalt, copper, aluminium, etc. At the same time, these researches are promoting existing and creating prerequisites for the introduction of new technologies of production of liquid metals. The result of these studies is taking of technology of production of new materials at semiindustrial plants of the Department. In these plants besides making casts for the purpose of the experimental part of scientific and research work is also possible and commercial test production of metal materials.

Results

1. Innovating technology of super-alloy C 263 for precision casting regeneration chippings resulting machining
2. Innovating production Maraging steel at semiindustrial aggregates
3. Innovation Austenitic steel production for medical application

The most important prototypes, products, services, strategies & methodology

1. Innovation prototypes of products from materials Nitronic 60 and Nimonic 80A, Phase I-Innovation wire for prototyping steel Nitronic 60
2. Innovation prototypes of products from materials Nitronic 60 and Nimonic 80A, Phase II-Innovation rod prototype rollers of superalloy Nimonic 80A
3. Innovating production of austenitic stainless steel to create a leading ring intermetallics reinforced with A286 turbocharger

Important projects

1. International and national projects in the field of melting and metal casting
2. Establishing of the Institute of materials in Sudan

Resources

- two open induction furnaces whose capacity is 65 kg
- two vacuum induction furnaces whose capacity is 20 kg and 80 kg, respectivly
- device for electro slag remelting max. casting diameter 250 mm

Department of Physical Metallurgy Metallographic Laboratory

Metallographic Laboratory is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Emina Kratina, BSc.
Head of laboratory:
Mr. Sc. Belma Fakić
Email: belma.fakic@miz.unze.ba
Tel: +387 32 247 999
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

- Microscopical testing of metallic materials and alloys,
- Testing of microhardness of metallic materials and alloys
- Heat treatment of steel
- Electron microscopy

Results

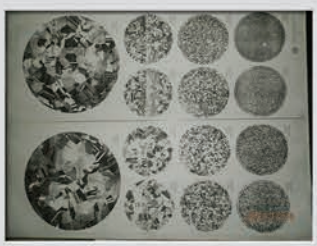
- Getting accreditation from national accreditation body BATA (since 1998. Year) based on EN 45001, and latter BAS EN ISO 17025: 2003
- Successfull participation in ILC/PT schemes which are organized by IFEP Germany and ILC Argentina
- Participation in the study for the Swiss company „Schindler"
- Participation in the study for companies in B&H such as: CIMOS - Gradačac, „Krupa Kabine"-Bosanska Krupa, Thermal power plants – „Kakanj" and „Tuzla", CIMOS NT Forging - Novi Travnik
- Big amount of work performed annually and increase of job amount from year to year

Resources

- Equipment for preparation of metallographic samples
- Optical microscope Olympus PMG3 with software Analysis 5.1
- Optical microscopes Leitz, Reichart, Carl Zeiss Jena
- Electron microscope PHILIPS XL-30
- Furnaces for heat treatments,
- Dilatometers for Ac points and TTT diagrams,
- Jominy device for determination of hardenability

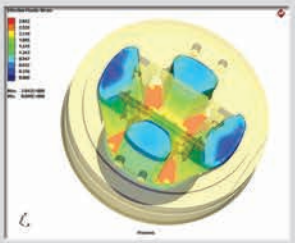
Commercial services

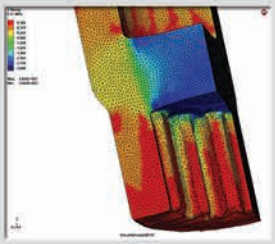
- Microscopical testing
- Different regimes of heat treatment
- We offer trainings for microscopically testing of metallographic samples
- Target groups are employees from SME who need to knowledge from metallography


The most important prototypes, products, services, strategies & methodology

- testing of microstructure and macrostructure of metallic materials and alloys
- determination of grain size,
- determination of non-metallic inclusions,
- perform different types of heat treatment,
- determination of TTT diagrams,
- determination of Ac points of steel,
- determination of layer thickness,
- depth of decarburisation,
- depth of carburisation,
- determination of microhardness,
- determination of microstructure of graphite.





Department for Ore and Iron

Department for Ore and Iron is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Mr. Sc. Amel Zahirović

Email: amel.zahirovic@miz.unze.ba
Tel: +387 32 247 999
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

- Analysis and preparation of iron ores and their products,
- Testing sinter and result analysis
- Exploring new methods for obtaining high-quality concentrates
- Development of new methods for iron ores preparations
- Optimization of existing technologies for preparing materials

Results

- Research and development sinter for Arcelor Mittal
- Making sinter and testing for Arcelor Mittal in Zenica in 2008 and 2009

Resources

- Pilot plant for sintering
- Rotary kiln for calcination, reduction, drying
- Devices for testing sinter
- Devices for crushing, grinding, screening, magnetic separation




Department for Plastic Processing of Metals

Department for plastic processing of metals is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Ivan Stergulc, BSc.

Email: ivan.stergulc@miz.unze.ba
Tel: +387 32 247 928
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

- Research in the field of technology hot and cold plastic deformation of steel and alloys,
- Improving the quality of existing products (production in small quantities)
- Objects of research are metallic materials with specific requirements in terms of shape, size, mechanical and microstructural properties.
- Involvement in projects of special interest (e.g. making armatures for Old Bridge in Mostar)
- Education personnel from Sudan within the Project of Establishing Material Research Centre in Sudan.

Results

- Mastering the technology of plastic processing tool steels and High-Speed Steels
- Mastering the technology of plastic processing steels and super-alloys for use in automotive industry (NITRONIC 60 i NYMONIC 80A)
- Research and development alloys for special purposes (shape memory alloys)

The most important prototypes, products, services, strategies & methodology

- Products of tool steels for work in the cold and hot condition
- Products of High-Speed Steel
- Products of heat resisting steels and alloys
- Development technologies for soft magnetic materials
- Prototypes of products for the automotive industry (NITRONIC 60, NYMONIC 80A, X15CrNiSi25-20)
- Development research in the field of shape memory alloy.
- Development technologies in the field of non-ferrous metals (copper, brass, etc.)

Resources

- hydraulic press 200t (type Pitzman and Pfeifer)
- hammer type B50 - Vychodoslovenske strojarne
- rolling mill diameter 270 mm (type "SKET")
- rolling mill diameter 230 mm (produced in the Institute)
- rolling mill for the cold rolling, type "LOMA"
- drawing bench type "SCHUMAG"
- two drawing machines, type "ARBOGA"
- two vacuum furnaces for the heat treatment (types "BALZERS" and "WILD BARFIELD")
- eight furnaces for metal heating (from "CEV" Čačak and "RADE KONČAR" Zagreb)



Department for Physical Metallurgy Mechanical Laboratory

Mechanical Laboratory is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Emina Kratina, BSc.
Head of laboratory:
Branka Muminović, BSc.
Email: branka.muminovic@miz.unze.ba
Tel: +387 32 247 999
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

- Tensile testing – Method of test at ambient temperature and Method of testing at elevated temperature (to 850C)
- Hardness test – Method Brinell, Vickers and Rokwell
- Hardness testing in the field
- Impact testing – Method of test at ambient temperature and Method of testing at low temperature (to -60C)
- Bend test
- Testing of wire – Simple torsion test and Reverse bend test
- Steel for the reinforcement and pretressing of concrete – Reinforcing bars, Welded fabric
- Destructive test on welds in metallic materials – tensile test, bend test, impact test
- Creep testing
- Determination of the actual number of cycles and dynamic strength
- Verification of static uniaxial testing machine – Verification and calibration of the force-measuring system
- Verification and calibration of Brinell, Vickers and Rockwell testing machine
- Assembly tools for screws and nuts - Requirements and test methods for design conformance testing, quality conformance testing and recalibration procedure

Resources

- Universal hydraulic machine for static testing – 200 kN and 500 kN with software testXpert by ZWICK
- Brinell, Vickers and Rockwell hardness testing machine
- High-frequency pulsator for dynamic testing
- Impact testing machine
- Equipment for calibration measurement equipment for force - MGC plus system with Force transducer (measuring range from 50 N to 5000 kN)
- Reference hardness blocks for calibration hardness testing machines
- Equipment for calibration hand torque tools

Commercial services

- Mechanical testing of metallic materials in the laboratory
- Calibration of equipment for force, torque and hardness in the laboratory and in the field
- Monitoring for sampling in the field
- Technical supervision during testing
- Performing internal audits in accordance with ISO/IEC 17025




Results

- The laboratory is accreditated for mechanical testing of metallic materials and for calibration mesurement equipment for force, torque and hardness since 1998 by the Accreditation body of Bosnia and Herzegovina – BATA
- Succeessful participation in PT/ILC schemes which are organized by accreditation providers
- Participation in interlaboratory comparison with laboratories with similar activities
- ILC organisation and analysis of results

Developed entrepreneurship/specialized/customized trainings

The training of staff from Sudan in the field of mechanical testing of metallic materials - predicted in the period of next five years.

Department for Welding

Department for Welding is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Abdulah Frndić, BSc.

Email: abdulah.frndic@miz.unze.ba
Tel: +387 32 247 999
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

- Application and development of welding techniques and welding technologies
- Providing support to the testing laboratories and other parts of the Institute

Results

- Training and certification of significant number of candidates
- Repairing of vital machnie parts using welding processes

Resources

Welding devices for:
- MMA welding,
- TIG welding,
- MIG/MAG welding
- apparatus fog gas welding

Places (areas) for training and certification of welders

Commercial services

- Training of welders
- Certification of welders
- Qualification of welding procedures
- Repair welding
- Presentations of welding equipment and welding consumables




Department of Protection and Ecology

Department of Protection and Ecology is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Halim Prcanović, BSc.

Email: halim.prcanovic@miz.unze.ba
Tel: +387 32 247 999/180
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

- Continuous messurement of air quality (Imission)
- Monitoring of pollutant emission in the air
- Inspection of working equipment
- Fire protection (inspection of systems for fire protection)
- Inspection of vehicles for carriage of dangerous goods by road (ADR)
- Inspection of vehicles with drive on LPG and CNG
- Miscellaneous electrical measurement
- Training for drivers according to ADR
- Training for operators of crane, lifting trucks, boilers and central heating, flammable liquids and gases

Results

Most important result of this department support for local economy in achieving necessary documentation for everyday operation such as: different kind of permits for work place, machines, vehicles etc., education, measurement reports ....

Resources

There are eqipment, software and test facilities in laboratory in Department for protection (work protection and fire protection) and ecology on the WEB site of Institute "Kemal Kapetanović" (www.miz.ba)

Commercial services

We have commercial services- consulting and training for firms in B&H



Department for Metallurgical Chemistry

Department for Metallurgical Chemistry is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Mr. Sc. Suvad Kesić
Kimeta Čaušević, BSc.
Email: suvad.kesic@miz.unze.ba
Tel: +387 32 247 999
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

- Chemical analysis of metalic materials
- Chemical analysis of non-metallic materials (ores, slag, refractories materials, stone etc.)
- Physical-chemical characteristics of solid and liquid fuels and lubricants (coal, petroleum and petroleum products)
- Chemical tests of waste water (monitoring of industrial waste water and drafting of EBS)
- Possibilities of internship for researchers from different companies
- Possibilities to provide services to universities for work by students and facultative visits of students
- Testing of refractories-refractoriness; refractoriness under load with rising temperature, the resistance to thermal shock; the permanent change in dimensions; cold crushing strength.
- Testing of concrete-compression test of concrete specimens; method of test for impermeability; subsequent testing of concrete compressive strength; wear test of grinding wheel method.
- Testing of nature stone and stone agregate-physical-mechanical characteristics

Resources

- AAS-Atomic Absorption Spectrophotometer
- OES – ICP-Inductively Coupled Plasma
- Device for determination content of C and S
- Photometar
- Kalorimetar
- pH metar
- Scales
- Diferent tipes of furnaces
- Other standard laboratory equipment and accessories
- Universal hidraulic machine 200 and 500 KN
- Electric chamber furnace
- Kriptol furnace for refractoriness

Results

- In 2001 Chemical-ceramicmineralogical laboratory has got accreditation certificate according to standard EN 45001
- Standard BAS EN/ISO IEC 17025/2006 for testing and calibration laboratories
- Chemical laboratory is accreditated for chemical analysis of steel
- Ceramic-mineralogical laboratory is accreditated for testing mechanical and physical characteristics of refractories and construction materials
- In 2013 accreditation is renewed




Department for Physical Metallurgy
Physical Laboratory

Physical Laboratory is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Mr. Sc. Birman Lošić

Email: birman.losic@miz.unze.ba
Tel: +387 32 247 999 (123)
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

- Visual testing of welded joints, castings and forgings
- Visual (endoscopic) testing of welded joints i plant
- components (vessel under preassure, pipes etc..)
- Magnetic particle testing of welded joints, castings and forgings
- Ultrasonic testing of welded joints, castings and forgings
- Radigraphic testing of welded joints, castings and forgings
- Ultrasonic thickness measurement
- Coating thickness measurement

Resources

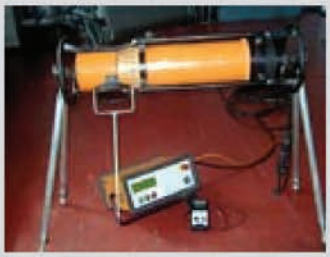
- Industrial endoscope IV8 C6 Olympus
- Boroskop KMI KLS-201 Olympus
- X-ray device ERESCO 42 MF Richard Seifert
- Ultrasonic device USN 50 Krautkramer Branson
- Ultrasonic thickness measuring device DME-DL Krautkramer Branson
- Hand magnet yoke TWM 220-N Tiede
- Hand magnet yoke TWM 230-A Tiede
- Coating thickness measuring device DUO-CHECK List Magnetic

Results

The Laboratory successfully support export-oriented companies of metal processing sector in Bosnia and Herzegovina. In the postwar period has given a significant contribution to the diagnosis and revitalisation of a number of plants, their maintenance and safe service up to date (thermal power plants, pulp and paper plants, etc.).
From January 2011, laboratory is accredited by the NA-Norwegian accreditation body .

Commercial services

- Non-destructive testing (IBR) of welded products, castings and forgings
- In-service testing of plants



Department for Heat Transfer and Measurements

Department for Heat Transfer and Measurements is a part of the Institute of Metallurgy "Kemal Kapetanović"

Contact

Head of department:
Narcisa Jarović-Bajramović, BSc.

Email: narcisa.bajramovic@miz.unze.ba
Tel: +387 32 247 999
Fax: +387 32 247 980

Address: Institute of Metallurgy "Kemal Kapetanović"
University of Zenica
Travnička cesta 7
72000 Zenica
Bosnia and Herzegovina

Activity

Within department there are numerous activities such as: testing and reparation of safety valves. Testing of temperature profile of different types of oven, furnaces, driers, heat pipes etc.
Within laboratory the main activities relates to calibration of temperature and pressure devices, sensors and measures.

Results

- Accreditation of the laboratory is based on BAS EN ISO/IEC 17025. Laboratory for technical measurements is accredited by BATA (Bosnia and Herzegovina accreditation body) since 2005 in field of calibration of temperature and pressure sensors, measures and devices. The laboratory has been accredited by NA – Norwegian Accreditation Body in field of temperature, since January 2011
- Succesfull participation in interlaboratory comparison
- Great amount of work performed annually and increase of job amount from year to year

Important projects

Project: „Sanation of part of infrastructure and purchase of technical equipment in Department for heat transfer and measurements" within the program under the number 7: „Support to public higher education institutions (universities) important to the Federation of Bosnia and Herzegovina. This project is approved by the Federal Ministry of education and science.

The most important prototypes, products, services, strategies & methodology

The concept of doctoral thesis: „Development of prototype of apparatus for calibration of contact sensors for measuring surface temperature". Methodology that will be used for master thesis is known as „Evaluation of total measurment uncertainty of prototype apparatus for calibration of contact sensors for measuring surface temperature".

Resources

Our resources, equipment and facilities are placed within Institute of Metallurgy "Kemal Kapetanović" Zenica (within University of Zenica) and the best way to contact us is at www.miz.unze.ba , e-mail: miz@miz.ba





Laboratory for Sand Casting Properties Investigation

Laboratory for Sand Casting Properties Investigation is a part of the Faculty of Metallurgy and Materials Science

Contact

Head of department:
Prof. Dr. Sc. Ana Beroš
Dr. Sc. Hasan Avdušinović, Asst. Prof.

Email: ana.beros@famm.unze.ba
Email: hasan.avdusinovic@famm.unze.ba

Address: Faculty of Metallurgy and Materials
University of Zenica
Travnička cesta 1
72000 Zenica
Bosnia and Herzegovina

Activity

- Laboratory is used for molding sand preparation and investigation of the sand mixture

Results

- Investigation in frame of several PhD projects in field of Metal Casting

Important projects

- Investigation in field of Nodular casting (cooperation with foundry 'Novi Zivot')
- Investigation in field of new materials for vehicle industry (cooperation with University of Ljubljana)

Resources

- GF laboratory for send properties investigation
- ParticleSizer 'Malvern' for particle size distribution (up to 0,01µm)

Commercial services

- Trainings of foundry personnel in field of molding materials properties investigation

Laboratory for Chemistry

Laboratory for Chemistry is a part of the Faculty of Metallurgy and Materials Science

Contact

Technical manager of laboratory:
Prof. Dr. Sc. Farzet Bikić,

Email: farzet.bikic@famm.unze.ba
Tel: +387 32 401 831

Address: Faculty of Metallurgy and Materials
University of Zenica
Travnička cesta 1
72000 Zenica
Bosnia and Herzegovina

Activity

Research infrastructure of the laboratory for chemistry consists of the laboratory equipment, which is used for practical training of students and for scientific research and cooperation with business and other organizations.

The most dominant research domains of the laboratory for chemistry are:
- research in the field of analytical chemistry,
- research in the field of environmental analytical chemistry and environmental
- protection,

Results

- Results of investigation corrosion steel bars in concrete
- Results of investigation corrosion stainless steels
- Results of analysis of heavy metals in samples of different origin

Resources

- Atomic absorption spectrophotometer, PerkinElmer, AAnalyst 800
- UV–VIS spectrophotometer, PerkinElmer, Lambda 650
- FT-IR spectrophotometer, PerkinElmer, Spektrum100
- Potentiostat/Galvanostat, PAR, model 263A-2

Commercial services

1. analysis of heavy metals in samples of different origin
2. corrosion testing of metals in aqueous solutions (DC methods ASTM G 5, G 59, G 61)




Laboratory of Heat Treatment and Metalography

Laboratory of Heat Treatment and Metalography is a part of the Faculty of Metallurgy and Materials Science

Contact

Head of department:
Prof. Dr. Sc. Diana Ćubela

Email: diana.cubela@famm.unze.ba
Tel: +387 32 401 831

Address: Faculty of Metallurgy and Materials
University of Zenica
Travnička cesta 1
72000 Zenica
Bosnia and Herzegovina

Activity

- Student education about metalography (preparing of samples, microscope analysis), thermal analysis (dilatometry, STA analysis), heat treatment.
- Realization of science projects
- Commercial service of microstructure analysis, thermal analysis and heat treatment

Results

- Implementation of project: Supplying the laboratory with equipment for thermal analysis (dilatometer and STA device).
- Cooperation with companies in metal industry

Important projects

- Application of new materials in automotive industry, Faculty of Natural Sciences and Technics, University of Ljubljana and Faculty of Metallurgy and Materials Science, University of Zenica, 2010 – 2011
- Optimization of thermal treatment of semi steel products for the automotive industry, Faculty of Natural Sciences and Technics, University of Ljubljana and Faculty of Metallurgy and Materials Science, University of Zenica, 2008 – 2010
- Adoption rods Prototype Roller of super alloys NIMONIC 80A, Phase II, No. E-1529-I, Januar – September 2007
- Magnetic properties of amorphous binary systems Zr-3d, Faculty of Metallurgy and Materials Science, University of Zenica and Faculty of Natural Sciences and Mathematics, 2006-2007
- Production of metal foam proceedings SRFS (Slip Reaction Foam Sintering), Faculty of Metallurgy and Materials Science, 2006 – 2007
- Technology research ductile iron for substitution malleable casting, Faculty of Metallurgy and Materials Science, 2004 – 2005
- Adoption NITINOL alloy production in terms semi industrial facilities of Institute of Metallurgy "Kemal Kapetanović", Faculty of Metallurgy and Materials Science and Institute of Metallurgy "Kemal Kapetanović", 2002 - 2004

Resources

- Automatic CUT precision machines (Struers) for cutting metallographic samples without deformation patterns for metal, electronic components, ceramics, composites, crystals, sintered carbides, minerals, fiber reinforced materials, biomaterials etc.
- LabPress1-semi-automated press for hot mounting of metallographic samples (Struers)
- Vakumat –Epovac (Struers) for cold mounting of porous metallic and nonmetallic samples
- LabPol5-Semi-automated device for grinding and polishing samples (Struers) with LaboDoser.
- Dilatometar DIL-402 C/7/G (Netzsch) for analysis metal and nonmetal materials (to 20000C). It could be use for linear thermal expansion, coefficient of thermal expansion, the sintering temperature, the degree of shrinkage, volumetric expansion of density change, determination of softening point temperature, phase transformation etc.
- Optical microscope with digital camera Color View III (Olympus)-magnification 50-1000x
- Stereo microscope Leica with ICD digital camera and magnification 8-60x.

Laboratory of Non-Metallic Materials

Laboratory of Non-Metallic Materials is a part of the Faculty of Metallurgy and Materials Science

Contact

Head of department:
Dr. Sc. Marina Jovanović

Email: marina.jovanovic@famm.unze.ba
Tel: +387 32 401 831

Address: Faculty of Metallurgy and Materials
University of Zenica
Travnička cesta 1
72000 Zenica
Bosnia and Herzegovina

Activity

- Activities of laboratory are related to the testing of cement, lime, gypsum, asphalt, fresh and hardened concrete, concrete structures, and prefabricated elements, clay, brick products and other building materials.
- In addition to investigation of commercial construction materials, our laboratory is engaged in examining various natural and waste materials, byproducts from the production of various industries and finding their application in construction and production of new materials, as well as research aimed at increasing the durability of concrete structures.
- In the laboratory are realized experimental programs for PhD, MSc and graduate theses, and laboratory exercises for specialized subjects of study programs: Materials, Chemical Engineering, Engineering Product Design and Civil Engineering.

Results

Realised research projects:
- Structure and Phases Transformation in Clay during Sintering
- Defining Conditions for Synthesis of Amorphous SiO2, a Filler for Rubber, by Precipitation from Na-metasilicate Solution

Current research projects:
- Effect of composition of high alumina based multycomponent mixtures on refractory concrete properties
- Rating reliability of applications DTA, TGA and dilatometry in assessing the effect of shale on clay mixture for bricks

Commercial services

In cooperation with the Institute of Metallurgy "Kemal Kapetanović " Laboratory provides testing services of construction, refractory and ceramic materials and raw materials. Also, the laboratory performs characterization of natural non-metallic raw materials and by-products of industrial processes, investigating the possibility of their utilization in a variety of products, and the concrete and asphalt mix design.




The most important prototypes, products, services, strategies & methodology

Mullite based refractories:
The series of investigations where performed to demonstrate the possibilities of mullite based ceramics processing from electro-filter fines from Alumina factory "Birač" A.D. Zvornik and domestic raw materials: fireclay from „Klokoti" Busovača deposite (Region Central Bosnia). The preparation of samples were carried out in Laboratory of Non-metallic materials, while characterization of clay was performed by X-ray fluorescent analysis, differential thermal analysis, infrared spectroscopy, heating microsope and particle size analyser. Properties of sintered ceramic samples were studied by X-ray diffraction and Scanning electron microscopy. It was concluded that mullite-based refractory materials can be obtained by firing mixtures consisted of waste alumina fines and fireclay at 1600 °C for 120 min. The method has implications for the recovery and recycling of alumina wastes, besides the application of domestic fireclay for refractory production.

Precipitated silica:
Precipitated silica of highly dispersion degree was obtained using two stage neutralization of sodium silicate solution. In the initial stage, the sodium silicate solutions were destabilized by carbonization, and in the second stage neutralization was proceeded with introduction of hidrochloric acid into solution until pH value of solution dropped to 4. Precipitation parameters which were studied include temperature of precipitation, silicate ratio, reaction rate and reactant concentrations. Precipitation parameters and drying parameters were varied, and the effect of experimental conditions on silica properties has been established on the basis of SEM analyses, nitrogen gas absorption, dibuthyl phthalate absorption, specific surface and particle size distribution.

Resources

- HOFMANN, High temperature furnace HT2000.20,
- HOFMANN Chamber furnace K3/1300°C,
- DIL 402 C - Vacuum-tight, horizontal pushrod dilatometer, NETZSCH,
- Simultaneous thermal analysis STA 409 CD, NETZSCH,
- Ultrasonic tester, Palmer High Technology",
- Compression Testing Machine 2000 kN capacity,
- Flexural Testing Machine 150 kN capacity,
- Los Angeles Abrasion Machine,
- Marshall Automatic (Impact) Compactor,
- Set of Marshall Test Equipment 50 kN,
- Partical sizer Malvern 2000,
- Other testing equipment.

Laboratory of Technical Diagnostics

Laboratory of Technical Diagnostics is a part of the Faculty of Mechanical Engineering

Contact

Head of department:
Dr. Sc. Sabahudin Jašarević, Asst. Prof.

Email: lab_td@mf.unze.ba
Email: sjasarevic@mf.unze.ba
Tel: +387 32 449 145, 449 120
Fax: +387 32 41 87 49

Address: Faculty of Mechanical Engineering
University of Zenica
Fakultetska 1
72000 Zenica
Bosnia and Herzegovina

Activity

- Measurement and control of vibration level of technical systems,
- Analysis of the vibrational state of technical systems,
- Static and dynamic balancing of rotating systems in their own bearings,
- Diagnostics of roller and sliding bearings by SPM method
- Noise test,
- Thermal tests,
- Ultrasonic defectoscopic tests,
- Researches based on the application of stroboscopic effect,
- Laser tuning and control of alignment of joined parts, and especially, rotating systems,
- Measurement and control of number of rotations, etc..

Results

After 25 years of scientific-research and professional work, results of this laboratory and its workers are: many scientific-research and professional works for the needs of business subjects, and as well, for those in the field of fundamental research. There are more than 150 expertise services done with over 1,000 diagnosed, repaired, balanced or controlled technical systems by methods of vibration analysis, noise analyses, SPM methods and other diagnostic methods – this confirms high level of expertise and professionalism shown on previous engagements. Also, there are engagements in regard to forensic (judicial) expertise, expert analyses, laboratory services, professional seminars, conferences and training services for the employees on maintenance and technology in factories. There are many factories, where our employees have worked (in almost every plant of steel factories in Zenica and Ilijaš; mines in Kakanj, Breza and Zenica; Kakanj Cement Factory; Natron in Maglaj; "Pobjede" in Tešanj; "Energana" in Travnik; Thermal Power Plant in Kakanj; Paper Factory in Drvar; Factory of plaster boards in Donji Vakuf; "Krivaja" in Zavidovići; KTK in Visoko, "Mediapan" in Busovača, UNIS Sarajevo, Hydropower Plant in Bihać, and in many other companies.

The basic principles for the laboratory work are expertise and qualifications for performing the above-mentioned tasks, quality and speed of service, which are always adjusted to the needs of a client. Our work is in line with the relevant European regulations, standards and recommendations, seen in the use of the appropriate ISO, VDI, EN, JUS, BAS, BS, DIN and other standards and recommendations, different software packages and programs, and as well, the expert systems. We did not forget the guidelines of the standards ISO 9000/2000 and ISO 14 000

Also, the laboratory provides an excellent opportunity for students of I, II and III study cycle at the Faculty of Mechanical Engineering of UNZE – they can see here all potential maintenance activities, which can occur in business systems, and they can completely finish their RDI tasks on the test models and pieces of equipment available in the laboratory.





Important projects

International:
Process planning using low-budget virtual reality technology, FTN University of Novi Sad – University of Pečuj (Hungary) – Unviersity of Zenica Univerzitet; Project funded by the Government of Vojvodina, 2006/07

Tempus:
Quality management procedure for promoting university-enterprise cooperation (QPPEUC); TEMPUS Project SCM CO24A06_BIH; Project funded by the EU Tempus-Mundus Fund

National projects:
- Center for Vehicles - Feasibility Study (Feasibility Project), Project for Zenica-Doboj Canton; Institute of Mechanical Engineering (N-74), Zenica, November 2000.; UDC 621.7
- "Needs and possibilities for forming the capacity for repairing armature in RO steel factory "Zenica" in 1989" Project for RO Steel factory "Zenica"
- The issue of a traffic noise as an aspect of quality of life, University of Sarajevo, Faculty of Mechanical Engineering in Zenica, ISBN 9958-617-04-8, COBISS / BIH-ID 7064838, November 1999, Zenica.
- Industrial noise – does it affect the process for obtaining the certificate of the series ISO 14000?, University of Sarajevo, Faculty of Mechanical Engineering in Zenica, ISBN 9958-617-04-8, COBISS / BIH-ID 7064838, 1999, Zenica.
- "Impact of mechanical system elastic support on the level of undesirable vibrations in exploitation", Institute of work productivity, Number 4, Ljubljana 1991

Important patents or other research

- Application of maintenance, regarding the current state, on the turbine blocks in the company "Željezara Zenica", 1987-1992.
- Development of maintenance concept, regarding the current state, in wood processing industry, Natron, Maglaj, 1998
- Problems of community noise and expertise on building construction solutions on the building "RMK promet Zenica", 1990.
- Researches on causes of some undesirable vibrations of some technical systems in metallurgy, 1988-1992.
- Diagnostics of state of technical systems of the mine "Stara jama" Zenica with the proposals of solutions, 1999
- NDT, thermo-visional and vibration analyses as the key maintenance technologies regarding the current state in the cement industry, project for Heidelberg cement, Kakanj, 1999
- Nature of vibrations, after the repair, of the large turboenergy groups as a remont quality assessment parameter: TE Kakanj, PU "Elektroprivreda BiH", 2000.
- Repair of the ventilation systems of flue system of boilers plants in thermal power plant in Kakanj, 2001
- Vibration analysis and diagnosis of state of aggregate in HE Una Kostela - Bihać as a parameter of technical evaluation of the project; contractor: PU Elektroprivreda BiH, HE-Kostela Una, Bihac
- Development of modern methods of technical diagnostics and applications in aviation, phd research of the candidate mr Radoja Karadzic.

Resources

- Movipack Analyiser - Dual-channel modular system for vibration analysis of the system state (Manufact. 01 dB METRAVIB)
- OPTALIGN-PLUS - Device for laser control and adjustment of alignment of shafts
- BK-Noise Level Analyser 4427 - Device for acoustic diagnostics (Manufact. Bruel & Kjaer & Schenk Denmark / Germany)
- SPM analyzer of bearings (Manufact. SPM Sweden)
- A test table for complex vibration states
- Simulator of vibrations - ventilation system – EM - elastic bearings
- Stroboscopic device
- Contact and contactless temperature gauges
- Thermal Imaging Cameras
- Software for vibration (for learning) (i-Learn Vibration)
- MARLIN detector of status Marlin Condition Detector Pro IS CMVL 3600 IS
- Sound level meter (Sound Level Meter Type 2250) (Bruel Kjær)
- Device for detecting machine availability (Leonova)

Laboratory of Applied Mechanics

Laboratory of Applied Mechanics is a part of the Faculty of Mechanical Engineering

Contact

Head of department:
Prof. Dr. Sc. Elma Ekinović

Email: eelma@mf.unze.ba
Tel: +387 32 449 120
Fax: +387 32 246 612

Address: Faculty of Mechanical Engineering
University of Zenica
Fakultetska 1
72000 Zenica
Bosnia and Herzegovina

Activity

Vibratory stress relieving, residual stress measurement, stress-strain analysis, numerical simulations and analysis (static and dynamic), design, NDT inspection (UT-2), measurement of physical problems as strain, displacement, force, accelerations, preassure, revolutions.

Results

- Development of the VSR methodology application on large constructions, applied in several industrial projects,
- Assesment of the structural integrity and life of pressure vessels,
- Measurement of residual stresses with application of hole drilling method at mechanical constructions,
- Static and dynamic testing of different kind of structures adding numerical simulations.

Important projects

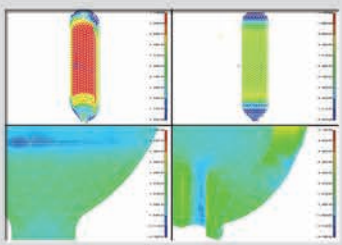
„PERFORMANCE ANALYSIS OF SUBSTITUTION OF APPLIED MATERIALS USING FRACTURE MECHANICS PARAMETERS", supported by Federal Ministry of Education and Science of Bosnia and Herzegovina under project No. 03-39-5980-50-2/08.

The most important prototypes, products, services, strategies & methodology

We have developed vibrorelaxation stress relief (VSR) methodology.
This methodology is applied for large welded steel structures.

Resources

- Residual stress measuring-MTS 3000- http://www.mts3000.com/
- Data Acquisition System Spider 8-30 and Spider 8-5 5 with
- force, displacement, pressure, acceleration and revolution transducers. http://www.hbm.com/en/menu/products/
- Ultrasonic flaw detectors Phasor XS - http://www.gemcs.com/en/ultrasound/portable-flaw-detectors/phasor-series.html

References

- Mobile belt conveyor Š18-A designing, Arcelor-Mittal Zenica d.o.o. Zenica, Department of Ore preparation and agglomeration,
- Expertise on Vibratory Stress Relieving procedure applied on grid welded construction ''ASSY BASIC FRAME BR. 0101'' in Company »GS-TMT« D.D., Travnik,
- Study - an analysis of right hood exhaust fan vibration of flue gas block No.5 in Kakanj,
- An analysis of static and dynamic stress-strain state of repaired bucket wheel excavator SH630, Lukavac
- Scientific study of the dynamic state of turbogenerator NE - T1319 "SIEMENS SCHUCKERT" in SISECAM SODA LUKAVAC
- Scrubbing system line filters F1, F2, F3, F4, filters and lime dosing system dusty bag - a machine part TSP-B-01-11/12, Department of agglomeration and preparation of ore, ArcelorMittal Zenica,
- Study on control and stress relieving by VSR on flange connections of oil reservoir JANAF, Terminal Sisak, Croatia,
- Vibrational relaxation of residual stresses in northeast welded base platforms and nivelators of charging car, JMH HENDERSON, UK, METALNO, ZENICA
- Nostrification mechanical part of the project documentation project'' The collection and treatment of waste water in Bihac - Component 2 (a plant for wastewater treatment)
- Nostrification of Technical Documentation of "Screwfeeder Charge Car", "Department coke plant ArcelorMittal Zenica", "JOHN M HENDERSON" United Kingdom
- Expertise of vibrational relaxation of grid welded structures'' ASSY BASIC FRAME NO. 0101'' in factory machinery »GS-TMT" d.d
- Nostrification on technical documentation of a main project - machine part: Use of renewable energy resources for the system of central heat supply (CTS) in Nemila
- Nostrification on technical documentation of project main – mechanical part '' Systems for water sealing cap riser column and hydro injection during the filling mixture of coal in the furnace coke batteries,'' OMEV Italy
- Nostrification on technical documentation of Reconstruction-dedusting system in the area of the mixer to the BOF steel plant EC-02/09 (Rev.1),'' KAPPA Filter Systems
- A report on the control and relieving of residual stresses on flanges of oil terminal'', JANAF, Sisak, Croatia
- Compressor station for dedusting of casting platform, Arcelor-Mittal Zenica doo Zenica, Department: Blast Furnace.

Laboratory for Metal Cutting and Machine Tools (LORAM)

Laboratory for Metal Cutting and Machine Tools is a part of the Faculty of Mechanical Engineering

Contact

Head of department:
Prof. Dr. Sc. Sabahudin Ekinović

Email: sekinovic@mf.unze.ba

Tel: +387 32 449 135
Fax: +387 32 246 612

Address: Faculty of Mechanical Engineering
University of Zenica
Fakultetska 1
72000 Zenica
Bosnia and Herzegovina

Activity

LORAM lab is dedicated to the education of students at all levels of education, scientific and research work and production activities. LORAM provides practical support for students to overcome problems in the field of manufacturing engineering. Through learning activities that are performed in LORAM students obtain necessary knowledge of the procedures and methods of processing materials, and thus their involvement in the production processes in the industry is facilitated as well as the ability and skills necessary to start their own business.

Commercial services

- Educational seminars in the field of metal processing with demonstration,
- Processing of very hard materials (over 60 HRC) with high speed milling on 5-axial GDM - Deckel Maho Gildemeister machining center,
- Production services of high speed grinding-milling
- Production services of finishing of very soft materials (<100 HB)
- Design of technological procedures for processing,
- Accuracy testing of machines based on laser interferometry - Renishaw ML-1o laser (linear precision, angular deviations, flatness of the table ....)
- Rapid detection of the machine accuracy on the principle of QC10 Ball-bar system,
- Easy Laser D525 for the determination of the geometric parameters of machines,
- Compensation of the measured error of CNC machines using Error Compensation Software, without intervention on the mechanical elements of the system,
- 3D CAD design of products in SolidWorks software package, generating machine G-code to handle complicated shapes and their processing on the 5-axis milling machines,
- Analysis of the technological process and help by the selection of machinery,
- Systematic testing of construction materials machinability in terms of tool life, surface finish, cutting force, cutting temperature and chips form,
- Roughness measurements of machined surfaces. 3D capturing with optical tool microscope,
- Selection of the tools, optimization of processing regime and geometry tools
- Education in the field of CAD, CAM, CIM software packages ...

Resources

- Laser interferometer ML-10
- QC10 ballbar system
- Easy Laser D525 system
- DMU 60 monoBLOCK high spees 5-axis milling machine
- Industrial systems for education EMCO Concept MILL 155 and Concept TURN 155
- 3D surface capturing machine MarSurf TS 50
- Measuring of roughness - Perthometar M1
- High speed camera MiniVis
- Dynamometer - Kistler FMD and Kistler FMR

References

References of the LORAM laboratory are hundreds of publications, projects and expertises over the past 25 years. The most important are:

1. Ekinović, S., Begović, E., Ekinović, E., Fakić, B., 2013, Cutting Forces and Chip Shape in MQL Machining of Aluminium Bronze, Journal of Trends in the Development of Machinery and Associated Technology, eISSN 2303-4009, 17, No.1: 17-20.
2. Mehmadović, M., Ekinović, S., Šarić, E., Butković, S., 2013, Metodology for the White Layer Formation on the Machined Surface During Longitudinal Turning of Hardened Steels, Journal of Trends in the Development of Machinery and Associated Technology, eISSN 2302-4009, 17, No.1: 25-28.
3. Ekinović, S., Prcanović, H., Begović, E., 2013, Callibration of Machine Tools by Means of Laser Measuring Systems, Asian Transactions on Engineering, 02, No.06: 17-22.
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8. Ekinović, S., Begović, E., 2007, An Approach to Determine Transition Area from Conventional to High-Speed Machining by Means of Chip Shape Analysis, Archives of Materials Science and Engineering, World Academy AMME, 28, No.1-4: 35-39.
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11. Ekinović, S., Dolinšek, S., Begović, E., 2005, Machinability of 90MnCrV8 Steel During high-Speed Machining, Journal of Materials Processing Technology, Elsevier, 162-163: 603-608.
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13. Dolinšek, S., Ekinović S., Kopač, J., 2004, A Contribution to the Understanding of Chip Formation Mechanism in High-Speed Cutting of Hardened Steel, Journal of Material Processing Technology, Elsevier, 157-158: 485-490.
14. Ekinović, S., Brdarević, S., 2003, Optimization of the Cutting Tool Geometry by Use of Different Experimental Plans, Technical Gazette, 10, No.1: 13-17.
15. Ekinović, S., Dolinšek, S., Kopač, J., Godec, M., 2002, The Transition From the Conventional to the High-Speed Cutting Region and Chip-Formation Analysis, Journal of Mechanical Engineering – Strojniški vestnik, 43, No.3: 133-142.
16. Ekinović, S., 1999, A New Machinability Function, CIRP Journal of Manufacturing Systems, 29, No.4: 345-349.
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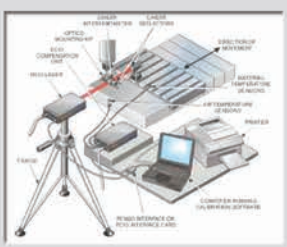


Laboratory for Measurements and Automation

Laboratory for Measurements and Automation is a part of the Faculty of Mechanical Engineering

Contact

Head of department:
Prof. Dr. Sc. Nermina Zaimović-Uzunović

Email: nzaimović@mf.unze.ba

Tel: +387 32 449 138
Fax: +387 32 246 612

Address: Faculty of Mechanical Engineering
University of Zenica
Fakultetska 1
72000 Zenica
Bosnia and Herzegovina

Activity

Laboratory for measurements and automation is an integral part of the Department of Automation and Metrology. It is dedicated to the education of undergraduate and postgraduate studies in the field of metrology. Besides, laboratory provides services for external clients. Experimental methods are used to determine the displacements, stresses and strains of different structures and objects. Also it is possible to carry out long-term monitoring of strains and telemetrically track the results, especially by commissioning of bridge cranes constructions.
In the field of experimental methods and design the laboratory is engaged in:

- examination of the strains of different types of mechanical and civil engineering structures under load or in normal operation;
- testing and measuring of displacements over a long period of time in several places on the construction;
- testing the samples and parts of structures for determined loads on fixed equipment;
- precise measurement and testing of the dimensions by the 3D coordinate measuring machines;
- digitizing and reverse engineering of mechanical parts using laser color 3D scanner;
- designing systems for measuring of physical quantities;
- consultation by the selection of measuring equipment;
- analysis of the results of different types of measurements.

Important projects

- Post-graduate studies "Metrology", EU TEMPUS SCM (Structural and Complementary Measures) Project, October 2006-October 2007
- "Application of an industrial robot for positioning of measured objects within the coordinate measuring machine" , national project, 2012
- Using the finite element method for digitizing thin-walled products, bilateral project BH-Slovenia, January 2005 - December 2006th
- Measuring the displacement of the second path of boiler block 7-230 MW in hot and cold condition in a power plant "Kakanj ', expertise in power plant" Kakanj ", May 2002.
- Conceptual design of the measuring system for detecting defects in processed prodacts, project for Binas Bugojno, November 2002

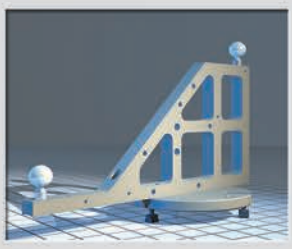



Resources

- Expandable framework for construction testing 1800 x 1800 mm with assembly for load simulation and accompanying equipment;
- Portable measurement system for telemetric measurements SCADA with amplifier, concentrator, piezoelectric and resistive sensors, data processing software and other features;
- Software LabView 6i;
- Multimedia PC lab with 12 computers, projector and 100 Mbps LAN;
- 3D scanner Nextengine;
- Graphical workstation IBM Intellistation M Pro;
- Coordinate measuring machine Zeiss Contura G2 700 Aktiv (measurement range: 700x1000x600 mm, measurement uncertainty according to ISO 10360-2: MPE_E=(1,8+L/300 μm, MPE_P=1,8 μm);
- CMM software Calypso CNC Geometry;
- CMM software Calypso IGES Converter ;
- Industrial robot Mitsubishi Melfa RV-2AJ-S12 (Payload: 2 kg, Repeatability: ą0.04 mm).

Commercial services

- Laboratory is engaged in organizing, and conducting seminars in the field of measurements: Parameter vibration, force, torque, displacement, velocity, pressure, temperature, and workshops for the implementation of the ISO 17025 standard.



Laboratory for Fluid Mechanics and Hydraulics

Laboratory for Fluid Mechanics and Hydraulics is a part of the Faculty of Mechanical Engineering

Contact

Head of department:
Prof. Dr. Sc. Nedim Hodžić

Email: nhodzic@mf.unze.ba

Tel: +387 32 449 146, 449 120
Fax: +387 32 246 612

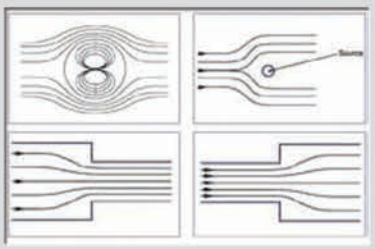
Address: Faculty of Mechanical Engineering
University of Zenica
Fakultetska 1
72000 Zenica
Bosnia and Herzegovina

Activity

- Education of students and attendees of specialized courses and seminars,
- Fundamental research in fluid mechanics and hydraulics,
- Verification of characteristics of hydraulic components and
- Verification of rheology characteristics of newtonian and non-newtonian fluids.
- Education of students of the Faculty of mechanical engineering in Zenica,
- Education of personnel from industry through seminars and specialized courses,
- Making studies, projects and expertise for industrial needs,
- Working on phds, Master theses and scientific works,
- Experimental research in the field of fluid mechanics and hydraulics.

Resources

- Pump station for working pressures up to 250 bar – working medium: hydraulic oil,
- Pump station for working pressures up to 700 bar – working medium: hydraulic oil,
- Pump station for grease as working medium,
- Digital electronic instrument for measurements of fluid temperature,
- Rotational viscometer and
- Control and steering components within hydraulic systems
- Portable data recorder, Model: HMG 3000
- Software for calculation of fluid mechanics, thermodynamics and hydraulics, Model: F1-CD-301 TECHNOLAB SA
- Educational wind tunel, Model: C2-10-A (C15-10-A) TECHNOLAB SA
- Laminar flow analysis table, Model: C-10 TECHNOLAB SA
- Piston pump test bench, Model: FM 23 TECHNOLAB SA
- Centrifugal pump test RIG, Model: FM 20 (FM 50) TECHNOLAB SA
- Series/Parallel pump test RIG, Model: FM 21 (FM 51) TECHNOLAB SA
- Flow visualization bench & mobile bed, Model: F14-MkII-A (F14-MkII-1) TECHNOLAB SA
- Mobile bed and flow visualizations table, Model: S2-4M-A TECHNOLAB SA
- Recycle Loops, Model: TH4-A TECHNOLAB SA
- Expansion Processes of a Perfect Gas, Model: TH5-A TECHNOLAB SA
- Educational Software for TH1 to TH5, Model: TH-304IFD TECHNOLAB SA
- Computer Controlled Heat Transfer Service Unit incl. Accessories, Model: HT10XC-A TECHNOLAB SA



Laboratory for Design and Technology in Wood Processing

Laboratory for Design and Technology in Wood Processing is a part of the Faculty of Mechanical Engineering

Contact

Head of department:
Prof. Dr. Sc. Darko Petković
Dr. Sc. Ismar Alagić, Asst. Prof.
Email: dpetkovic@mf.unze.ba
Tel: +387 32 449 145
Fax:+ 387 32 246 612

Address: Faculty of Mechanical Engineering
University of Zenica
Fakultetska 1
72000 Zenica
Bosnia and Herzegovina

Activity

The University of Zenica introduced a new vocational study „Production business" and courses within titled „Wood processing technologies" and „Industrial desing in wood processing". This study programm came as a result of engagement of the Faculty of mechanical engineering, the University of Zenica and partner institutions (Government of Zenica-Doboj Canton, REZ Agency, Chamber of commerce, etc.) in the last few years. The study concept was based on contemporary practice of profiling of such study and a concept 50:30:20, i.e. 50% teaching subjects about production and technology, 30% about economics, and 20% generally professional teaching subjects. This study was made to comply with credit transfer system, so-called ECTS model (European Credit Transfer System) and to enable vertical and horizontal mobility of students, which was one of the main directions of the Bologna declaration, signed also by Bosnia and Herzegovina. The fundamental basis for developing this study was to open this laboratory, which will be, in cooperation with the laboratories of the Institute and the Faculty, a basis for future development of a center for excellence in wood processing, done within a project with the University of Bern (Switzerland).

Laboratory offers training in the following fields:

- Analysis of technology and available work force in wood processing industry,
- Potential of biomass as an energy resource
- Characteristics of wood, durability and protection of wood
- Ergonomic design and modelling,
- 3D scanning of simple objects and mathematical modelling
- Technical documentation (constructive-technological documentation)
- Testing of furniture and pieces of furniture
- Standardization and EU technical regulations for wood processing
- Tools for wood processing
- Hydrothermal wood processing
- Chipboard and fibreboard

Commercial Services

Until now, this Laboratory implemented several training programmes for technical staff from SMEs in B&H, which were supported by the Government of FB&H (Federal ministry of craft, entrepreneruship and development) and the Regional development agency – REZ. On request, this laboratory provided the business sector with many idea solutions for certain premises and production was made on CNC processing center.

Laboratory for Environmental Monitoring

Laboratory for Environmental Monitoring is a part of the Faculty of Mechanical Engineering

Contact

Head of Department:
Prof. Dr. Sc. Šefket Goletić

Email: goletic@mf.unze.ba
Tel: +387 32 449 124
Fax:+387 32 246 612

Address: Faculty of Mechanical Engineering
University of Zenica
Fakultetska 1
72000 Zenica
Bosnia and Herzegovina

Activity

- Department of Ecology has established an environmental laboratory at the Faculty of Mechanical Engineering in Zenica. The vision of the establishment of the laboratory is to perform practical excersises for students and research work as well as to provide services to the market within its domain. It should be noted that the representatives of the Department of Engineering Ecology have been already involved in the preparation of certain national monitoring programs in some areas of the environment protection. Department believes that the human and technical capabilities (laboratory - with additional equipment) allow involvment in certain types of environmental monitoring at the national level. There are also the increasing demands for environmental monitoring at the local and regional level. The intention of the Department is to start procedures for accreditation of laboratory for environmental monitoring soon, what would have multiple benefits for the University.

Resources

- Smoke Gas Analyzer (TESTO 350 XL)
- Gravimetric Dust Concentration Measuring System (SICK GRAVIMAT SHC501)
- Smoke and SO2 Sampler (AGL Airtesting)
- M-Type Multi Element Sampler (AGL Airtesting)
- Environmental Air Monitoring System, NO - NO2 - NOx Analyzer, Ozone Analyzer, CO Analyzer, SO2 Analyzer (Airpointer)
- Gas Chromatograph (air TOXICBTX PID)
- Ambient Particulate Monitor (TEOM 1400a)
- Filter Dynamics Measurement System (8500 FDMS)
- Multi Parameter Measuring Instrument (Multi 350 I set with cable 3 m)
- IR Spectrophotometer (Spectrum 100)
- Peristaltic Pump (35700.93)
- Hydrometric Vane (RHCM 445 500)
- Hand-held Sound Level Meter (Type 2250 1 Brüel & Kjaer)

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Laboratory for Engineering Design LECAD II

Laboratory for Engineering Design LECAD II is a part of the Faculty of Mechanical Engineering and also a member of Engineering Design Center LECAD Group Ljubljana.

Contact

Head of department:
Prof. Dr. Sc. Senad Balić

Email: sbalic@mf.unze.ba

Tel: +387 32 449 125
Fax: +387 32 246 612

Address: Faculty of Mechanical Engineering
University of Zenica
Fakultetska 1
72000 Zenica
Bosnia and Herzegovina

Activity

- Pedagogical work in various fields such as the CAD/CAM/CAE, Information Technology, Programming, Computer simulation, PDM/PLM systems, etc;
- Application of numerical methods in the process of engineering design, as well as in solving various engineering problems;
- Scanning and 3D modeling;
- Prototyping;
- Industrial Design;
- Development of programs for CNC machines;
- Organization of seminars with topics: 3D modeling, numerical modeling methods, PDM/PLM systems, etc. with the participation of domestic and foreign experts;
- Thanks to the good cooperation with companies: Unigraphics, Siemens, IB Procadd, ib-CADdy, This laboratory has licensed software, among which the most important are: NX, FEMAP, SolidEdge,
- Teamcenter, as well as family of SolidWorks software.

Results

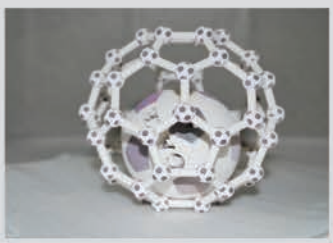
- Development of centrifugal turbopump based on application of numerical analysis of the entire pump flow tract,
- Development of gerotor pumps,
- Development of a Hollow-Jet valve through the application of Computer Aided Technology,
- Structural analysis and redesign of the butterfly valve,
- Research system for the enrichment of water oxygen on fish farms,
- Exploring the optimal model of technical Information System (PDMS) for small and medium-sized manufacturing enterprises in the Bosnia and Herzegovina,
- Analysis of the process of the production system and choice of software for business and technical information system in the company UNIS - PRETIS NIS Ltd.,

Commercial services

- A number of seminars on CAD/CAM/CAE, Information Technology, Programming, Computer simulation, PDM/PLM systems, etc;

Resources

- ZCorp Spectrum Z™510 color 3D printer
- ZCorp ZScanner® 700
- Foam shaper Megaplot T1300 Medium
- Computer centers with 30 CAD workstations



Institute of Economy of the Faculty of Economics

Institute of Economy is a part of the Faculty of Economics

Contact

Director:
Prof. Dr. Sc. Hasan Mahmutović

Email: hasan.mahmutovic@ef.unze.ba
Tel: +387 32 444 700
Fax: +387 32 444 421

Address: Faculty of Economics
University of Zenica
Fakultetska 5
72000 Zenica
Bosnia and Herzegovina

Activity

The research area encompasses studies in the fields of contemporary economics issues on macro and micro levels, including studies in the field of macroeconomics, European integrations, economic aspects of accession to the EU, development of industry and trade, direct foreign investments, providing consulting services to the business sector and state institutions at all levels, publishing, etc. It is important to emphasize that the research focus of the Institute adjusts according to the needs of time and direct clients.

Therefore, activities of the Institute of economy of the University of Zenica are:

1. organizing and implementing scientific-research work in the scientific field of economics and related scientific fields: a) fundamental and b) applied researches,
2. organizing and implementing scientific and research work: a) create development plans of economic subjects and units of local government and administration, b) make analysis and expertise in the field of economics and related scientific fields, c) create investment and other programmes and elaborates, and documentation bases, d) make studies about organization and enhancement of business operating of economic subjects, e) create professional propositions for solving different problems in operating of economic subjects, f) provide consulting services and other intelectual services to the economic subjects and other legal entities,
3. publishing results of scientific, development and professional researches,
4. organizing and co-organizing scientific and professional gatherings, seminars, courses, and business schools,
5. scientific training and inclusion of junior assistants and undergraduate and postgraduate students in scientific-research and professional work,
6. maintaining and developing scientific-research structure,
7. establishing connections between scientific research and higher education,
8. involving in international scientific activity, and as well among faculties,
9. organizing translating activities.

In that sense, the scientific-research work is primarly intended for the following groups of clients:

- decision-makers at all levels, in order to have an impact on creation of economic policy in Bosnia and Herzegovina, and to speed up the economic growth and development,
- direct business clients, primarly purchasers/buyers of services of scientific-research work,
- the general public, i.e. some results of researches will be presented to in order to inform and educate.

The scientific-research work of the Institute of economy mosty was based on the individual creative engagement of teachers and associates, who worked on monographies, studies, master and doctoral theses.

Center for Health Technologies and Innovativeness in Health

Center for Health Technologies and Innovativeness in Health is part of Faculty of Health

Contact

Head of department:
MA Mirza Oruč

Email: zfze@bih.net.ba
Tel: +387 32 444 780
Fax: +387 444 781

Address: Faculty of Health
University of Zenica
Crkvice 67
72000 Zenica
Bosnia and Herzegovina

Activity

- Collecting information and providing support to the innovators in the field of health,
- Providing services for developing medical/health technologies,
- Projects, education and promotion of development and improvement of health/medical technologies,
- Development of innovative awareness among employees in medical/health scientific/research institutions,
- Providing support to the medical/health institutions regarding development of innovative ideas,
- Providing support to the medical/health institutions regarding processes of implementation of new technologies and, also, supporting companies which are providing these types of services,
- Providing support to the research processes (especially to the targeted ones) and providing support in statistical data processing for health/medical institutions and other relevant bodies (ministries, health institutes, etc.) at the cantonal level and national level,
- Providing support to the individuals and institutions in creating and submitting applications to the EU funds, and other relevant funds in the field of health,
- Making relevant scientific research publications about health technologies and innovativeness in health sector,
- Participating in educational activities of the Faculty of Health by organizing various courses, seminars, trainings, workshops, etc.

Commercial services

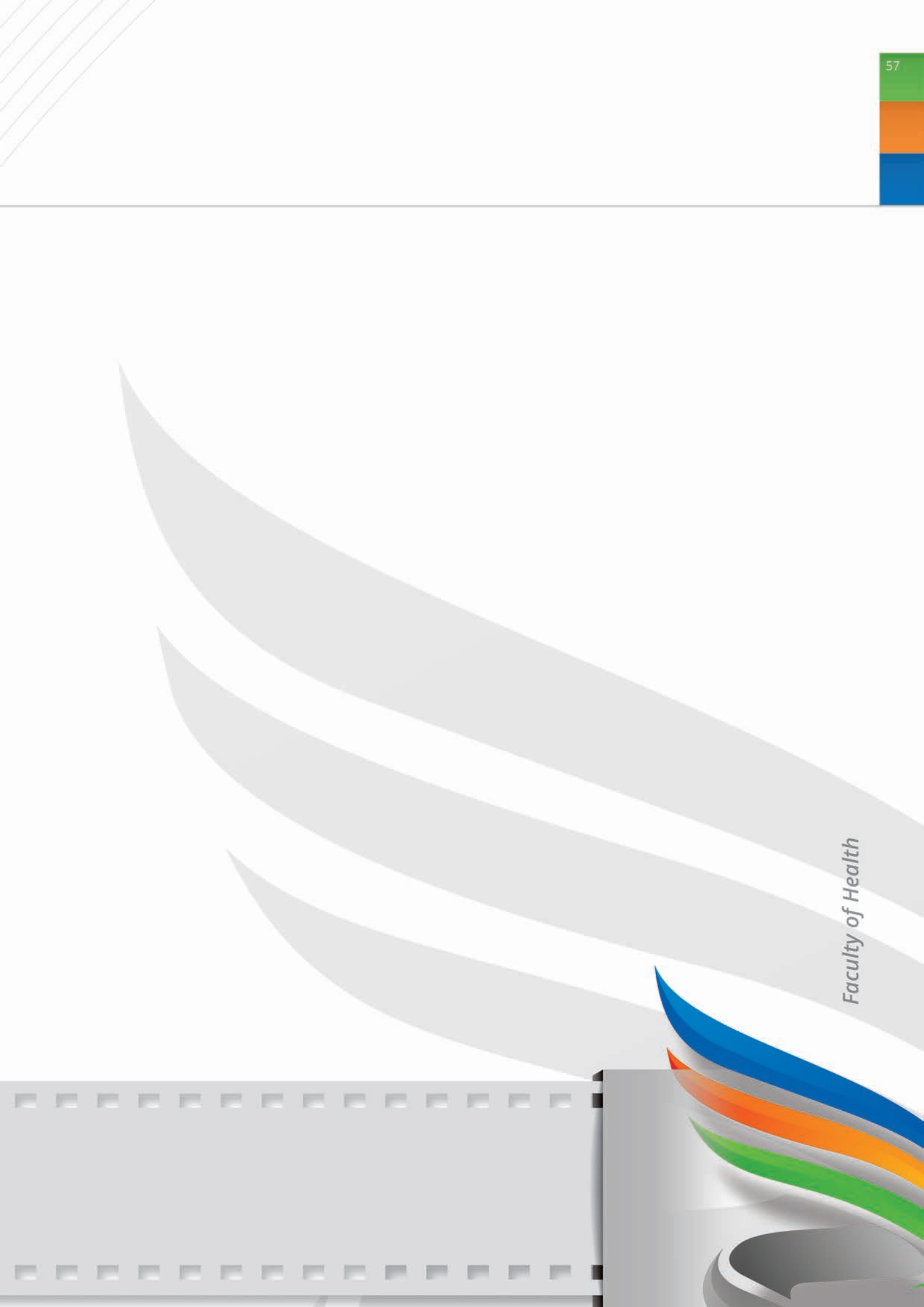
Regarding the issue of safety of medical equipment, this Center offers the following services:

- Examining and routine check of medical equipment preparation procedures
  (Here is implied that all points of medical equipment preparation will be controlled: preparations on the site where it will be used; before washing; washing process; disinfection; drying; controlling, maintaining and examining; control of packaging; sterilization and storing as the final phases of medical equipment preparations. For this, a mulitdisciplinary apporach of technical and medical staff is needed).
- Control, validation and testing of washing machines for equipment.
- Control, validation and testing of sterilization procedures of steam sterilizers in medicine, pharmacy, food industry, etc.
- Control of equipment for disinfection and sterilization of infectious waste.
- Control of packaging of medical substance.
- Validation of medical and laboratory equipment according to the specific ISO standard given to an institution as its certificate.

Resources

- Anatomy Laboratory
- Laboratory Microscope
- Photometer
- Centrifuge
- Water Bath WB 10
- Hematology Analyzer
- Automatic Analyzer





Faculty of Health

Modernizotion of WBC universities through strengthening of structures and services for knowledge transfer, research and innovation

University of Zenica
WBCInno Consortium

www.wbc-inno.kg.ac.rs
e-mail: wbc-inno@kg.ac.rs

Tempus

This project has been funded with support from the European Commission.
This publication reflects the views only of the author, and the Commission cannot be held responsible for any use vvhich may be made of the information contained therein.