

UNIVERSITY OF SPLIT

FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE

DEVELOPMENT STRATEGY OF THE FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE

FOR THE PERIOD 2017 - 2021

June 2017

Commission for preparing the Strategy:

Sven Gotovac, PhD, Full Professor – Head of the Commission Tomislav Kilić, PhD, Full Professor – Coordinator for preparing the Strategy Dinko Begušić, PhD, Full Professor Frano Barbir, PhD, Full Professor Ivica Veža, PhD, Full Professor Goran Petrović, PhD, Associate Professor Boris Ljubenkov, PhD, Associate Professor Branimir Lela, PhD, Assistant Professor

The Strategy was adopted at the 7th session of the Faculty Council, held on 21 June 2017.

CONTENTS

1.	INTRODUCTION
2.	BRIEF HISTORY
3.	FESB TODAY
	3.1. EMPLOYEES
	3.2. PREMISES AND EQUIPMENT
	3.3. ORGANIZATIONAL STRUCTURE
	3.4. STUDY PROGRAMMES AND STUDENTS
	3.5. SCIENTIFIC AND PROFESSIONAL ACTIVITIES
	3.6. ACADEMIC AND PROFESSIONAL CONFERENCES 15
	3.7. INTERNATIONAL COOPERATION
	3.8. PUBLISHING ACTIVITIES 19
	2.5. 7 052101 110 7 101 1120
4.	MISSION
4. 5.	MISSION
4. 5. 6.	MISSION 20 VISION 20 SWOT ANALYSIS 21
4. 5. 6. 7.	MISSION
4. 5. 6. 7.	MISSION
4. 5. 6. 7.	MISSION
4. 5. 6. 7.	MISSION 20 VISION 20 SWOT ANALYSIS 20 STRATEGIC GOALS, TASKS, INDICATORS AND STRATEGY BENCHMARKS. 21 STRATEGIC GOALS, TASKS, INDICATORS AND STRATEGY BENCHMARKS. 23 7.1. STUDENTS AND TEACHING ACTIVITIES. 23 7.2. RESEARCH ACTIVITIES 27 7.3. COOPERATION WITH THE ECONOMY, COMMUNITY AND THE SURROUNDINGS 29
4. 5. 6. 7.	MISSION 20 VISION 20 SWOT ANALYSIS 20 STRATEGIC GOALS, TASKS, INDICATORS AND STRATEGY BENCHMARKS. 23 7.1. STUDENTS AND TEACHING ACTIVITIES 23 7.2. RESEARCH ACTIVITIES 27 7.3. COOPERATION WITH THE ECONOMY, COMMUNITY AND THE SURROUNDINGS 29 7.4. INTERNATIONAL STANDING. 31
4. 5. 6. 7.	MISSION20VISION20SWOT ANALYSIS21STRATEGIC GOALS, TASKS, INDICATORS AND STRATEGY BENCHMARKS.237.1. STUDENTS AND TEACHING ACTIVITIES237.2. RESEARCH ACTIVITIES277.3. COOPERATION WITH THE ECONOMY, COMMUNITY AND THE SURROUNDINGS297.4. INTERNATIONAL STANDING.317.5. QUALITY ASSURANCE SYSTEM.32
4. 5. 6. 7.	MISSION

1. INTRODUCTION

The Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture is a modern higher education and scientific research institution focused on the development and application of the latest technology, with the strategic focus of achieving the highest international standards in scientific research, higher education and professional activities. Core activities of the Faculty include higher education, scientific research, development and professional activities in the area of engineering sciences – Electrical Engineering, Computer Science, Mechanical Engineering and Naval Architecture. As an institution providing education to experts in these areas, the Faculty was established with the primary purpose to support the development of the economy in the region. With the training of leading professionals in these areas, the Faculty successfully fulfilled its role and secured necessary human resources for the development of industrial sectors based on various fields of engineering sciences. High standing of the Faculty as scientific research institution has been confirmed by a number of successful research projects and published scientific papers, as well as cooperation with renowned national and international scientific research and academic institutions. The Faculty is actively involved in collaborative research projects and programmes on both national and international level and participates in the activities of scientific centres of excellence, acting as organiser and co-organiser of academic and research conferences on national and international level.

Continuing the progress made with the previous Development Strategy of the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture 2012 – 2016 and the Research Strategy for the period 2013 – 2017 and the overall growth and development during the past 57 years, in this document the Faculty Strategy for the next period is aligned with the following university, national and European strategic documents:

- Strategy of the University of Split 2015 2020;
- Network of Higher Education Institutions and Study Programmes in the Republic of Croatia;
- Strategy of Education, Science and Technology of the Republic of Croatia;
- EUROPA 2020 strategy for smart, sustainable and inclusive growth;
- Smart specialisation strategy of the Republic of Croatia for the period from 2016 to 2020.

Based on the review of the total capacities of the Faculty, Strategy of the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture 2017 – 2021 defines the following:

- mission and vision;
- strategic goals and tasks;
- indicators and benchmarks;
- persons and bodies responsible for implementation of defined strategic goals and tasks;
- strategic scientific research program.

2. BRIEF HISTORY

The Faculty of Electrical Engineering in Split was established in 1960 as a fully autonomous and independent organization within the University of Zagreb. The Centre for part-time study in Split was founded in the same year and operated within the Faculty of Mechanical Engineering and Naval Architecture in Zagreb. During its five years of activity, it was noticed that the preliminary part of study could be more effectively organized by using the resources of the Faculty of Electrical Engineering in Split. In 1965 the Centre for part-time study was replaced by the Mechanical Technology Department, which was founded at the Faculty of Electrical Engineering in Split, providing the two first years of study in Mechanical Engineering. The study programme provided an opportunity for continuing the study programme in Zagreb after the fourth semester.

In 1968 the Naval Architecture programme of study was established at the Department of Mechanical Engineering. The next step in the development of the Faculty was the introduction of postgraduate studies. Postgraduate studies in the field of Electronics and Telecommunications were conducted in 1969 and 1970.

In 1971 the Faculty was renamed as the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture in Split (FESB). Since 1974 the Faculty has been a constituent part of the University of Split. The Faculty, as one of the founders of the University, significantly contributed to its establishment and development.

The four-year Mechanical Engineering programme of study with its own curriculum was finally completed in 1976. Regarding the takeover of the educational programmes that were previously conducted at the Nautical College, the two-year post-secondary study programmes in Electrical Engineering, Mechanical Engineering and Naval Architecture were conducted in the 1979/80 academic year, according to the initiative of the University of Split in 1978.

The first phase in the construction of the new Faculty building was completed in 1980 at the location Visoka within the university campus and the second phase of the large project was completed in 2007.

Two new undergraduate study programmes were established in 2002: Computing and Industrial Engineering. The activities of the Bologna process of the harmonisation of the higher education systems in Europe were intensified at the end of 2004. Within this process, the Faculty introduced new degree programmes at undergraduate and graduate levels in 2005. At the same time, the Faculty adopted a new credit transfer system called ECTS (European Credit Transfer System). The new study programmes were organized in accordance with the recommendations of the European accreditation agencies. Five undergraduate study programmes were established: Electrical Engineering and Information Technology, Computing, Mechanical Engineering, Naval Architecture and Industrial Engineering, as well as seven graduate programmes: Control and Systems, Electrical Engineering, Electronics and Computer Engineering, Communications and Information Technology, Computing, Mechanical Engineering and Industrial Engineering. Also, four professional study programmes were established: Electrical Engineering, Computing, Mechanical Engineering and Naval Architecture. Furthermore, in 2006 two postgraduate study programmes for obtaining a Doctor of Science degree were established: Electrical Engineering and Information Technology and Mechanical Engineering.

3. FESB TODAY

The fundamental activities of the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture in Split are higher education teaching, scientific research, developmental and professional work in the fields of engineering sciences – in the scientific areas of Electrical Engineering, Mechanical Engineering, Naval Architecture, Computing and basic engineering sciences. With approximately 2600 students and over 250 employees FESB has become a respectable scientific and educational institution educating professionals, who represent the basis for the development of the economy and society as a whole, in the most advanced technologies. The vitality of FESB as a scientific and research institution has been confirmed through numerous successful research projects, published scientific papers, and especially through cooperation with recognized national and international scientific and academic institutions.

3.1. EMPLOYEES

FESB is one of the largest faculties of the University of Split and the largest engineering faculty outside of Zagreb. The Faculty employs over 250 full-time employees, 165 out of which are involved in the teaching process: 40 full professors, 22 associate professors, 36 assistant professors, 8 senior lecturers and lecturers, 31 senior assistants and assistants, 15 junior researchers and 17 laboratory technicians, participating in the teaching activities, scientific research and professional work. External associates from other higher education institutions and organizations are occasionally engaged in teaching. Structure of employees and external associates as per April 2017 is presented in Table 3.1

So far, four professors from FESB have received the honorary title of Professor Emeritus from the University of Split. The Faculty is a supporting member of the Croatian Academy of Engineering Sciences of Croatia with 5 regular members, 2 associate members, 3 associates and 1 emeritus member.

The employees at FESB are multiple winners of state, city and county awards and several of them have served as mayors, rectors, vice rectors etc.

	Employees o	f the Faculty	External associates		
Staff	Number	Average age	Number	Average age	
Full-tenured professors	29	57	4	66	
Full professors	11	59	1	45	
Associate professors	22	48	3	46	
Assistant professors	36	40	4	48	
Lecturers	8	47	8	44	
Assistants	31	29	70	35	
Junior researchers	16	35	/	/	
Project staff	17	29	/	/	
Professional associates	4	27	1	27	
Technical support staff	22	47	/	/	

Table 3.1 Structure of employees a	and external associates in 2017
------------------------------------	---------------------------------

Administrative staff	30	48	/	/
Supporting staff	26	49	/	/

3.2. PREMISES AND EQUIPMENT

Usable floor area of the Faculty building is approximately 27000 m2. The facilities are fully equipped, ensuring high standards necessary for study and scientific and professional work. The Faculty building has 9 auditoriums, 15 lecture halls, 85 laboratories, 8 computer labs and 1 modern, well-equipped distance learning classroom - TCR. All auditoriums and classrooms are equipped with computers, projectors and other additional technical equipment necessary for presentation of lectures and exercises. Students and employees have access to personal computers connected to a local computer network. The Computer Centre is an organizational unit of the Faculty which administrates the local network of over 500 computers and CARnet node. The library has a reading and study room for students and holds a collection of approximately 17000 books and over 350 journal titles. The Faculty consists of 100 offices for teaching staff, the Dean's office and the Registrar's Office. Moreover, the Faculty has a student restaurant, a coffee shop and a recreation centre with facilities available to students. The distribution of space according to purpose is presented in Table 3.2.

Table 3	.2 Spatia	capacity
---------	-----------	----------

Facility	Number	Floor area		
Classrooms/ lecture halls	24	2343,50		
Teaching labs/ practical exercise labs*	45	3739,67		
Computers labs	8	508,80		
Research laboratories *	40	1945,69		
Facilities for student body activities (study, projects, associations, student assembly, sports)	6	527,40		
Teaching staff offices	168	2856,00		
TOTAL				

* Some of the laboratories are used both for teaching and practical exercises. The table show the dominant purpose of the lab.

The Faculty facilities include 85 modern, well-equipped laboratories used for teaching and scientific and research activities. The instruments and lab equipment are acquired using the funds provided through projects and the financial resources of the Faculty. Table 3.3 shows a list of one part of capital equipment.

Tabl	le 3.3	Capita	lequipment	

Instrument (equipment)	Purchase value	Year of acquisition
Servo-hydraulic fatigue test machine INSTRON 8801 -	758.474,67 HRK	2003

Thermal camera	452.238,96 HRK	2008
Fuel cells testing unit	485.180,24 HRK	2007
GTEM chamber Schaffner/TESEQ GTEM 750	261.052,53 HRK	2006
3D digitizer, GOM ATOS I	500.004,80 HRK	2008
RF broadband amplifier	208.999,99 HRK	2008
Rapid prototyping 3DP unit	212.547,32 HRK	2010
CNC machining centre Spinner VC 560	507.865,78 HRK	2005
Solar power plant (photovoltaic system)	399,328,00 HRK	2013
Handheld RF and microwave analyser Agilent Fieldfox N99927A	211.119,84 HRK	2013
Robotic welding unit ABB	476.440,50 HRK	2013
CISCO Catalyst 4056 Series Switch	243.000,00 HRK	2014
Motor generator	212.906,25 HRK	2015
Electrocatalyst testing device with unit cell	406.500,00 HRK	2015
Laboratory hydrogen energy system	889.875,00 HRK	2016
Absorption heat pump	440.278,75 HRK	2016

3.3. ORGANIZATIONAL STRUCTURE

The Faculty has an internal division of organizational units for teaching and scientific research, administrative and technical work. The organizational units are as follows: Departments of the Faculty, the Department of General Courses, Chairs (Department sub-units), the Computer Centre, the Library and the Dean's Office. The Department as an academic organizational unit participates in organizing and carrying out teaching, scientific and professional work. The Faculty consists of the following Departments:

- Department of Power Engineering,
- Department of Electronics and Computing,
- Department of Mechanical Engineering and Naval Architecture,
- Department of Mechanical Technology,
- Department of Mathematics and Physics.

The Department of General Courses organizes and conducts courses of general content. The Chairs are established as sub-organisational units within departments, and as sub-organisational units perform some activities of the Department. The Computer Centre is an organizational unit of the Faculty which organizes and integrates activities related to the use of ICT for teaching, scientific research and professional activities of the Faculty. The Library is a special unit which collects and processes and provides teaching staff and students with publications, journals and information necessary for scientific-educational and professional activities of the Faculty and thus contributes to the development of scientific-educational research. The Dean's Office performs the administrative, executive, financial, technical and support activities of the Faculty.

3.4. STUDY PROGRAMMES AND STUDENTS

The study programmes are implemented in accordance with the Bologna Declaration, adopting measures with the aim of improving the quality of study and at the development of European values and European cooperation in the European Higher Education Area. Within its core activities, the Faculty organizes and implements teaching activities at two levels: university and professional studies.

University level education is divided into three cycles:

- o undergraduate university study,
- o graduate university study,
- o postgraduate university study.

Upon completion of the undergraduate university study lasting for 3 years, students are awarded the academic title of Baccalaureus with an area of specialisation. The second level of studies is graduate university study lasting for 2 years. Upon completion, students are awarded the academic title of Master of Science with an area of specialisation. The third level of university education is postgraduate study (doctoral study), lasting for three years and awarding the academic degree of Doctor of Science. Organisation of study programmes is shown in Figure 3.1, and structure of university level study programmes is shown in Figure 3.2.



Figure 3.1 Organisation of study programmes

Professional studies are implemented at the level of undergraduate professional study programme, lasting for three years and awarding the title of Vocational Bachelor in a specific field. The following undergraduate professional study programmes are implemented at the Faculty:

- Electrical Engineering, fields of study: Power Engineering and Electronics,
- Computing,
- Mechanical Engineering,
- Naval Architecture.

Students who complete the professional study programme have access to horizontal mobility and can enrol into differential courses. Upon completion of these courses, students acquire competencies that allow them to continue their studies at the graduate university programme.



Figure 3.2 Organisation of university study programmes

Approximately 2500 students are currently enrolled at the Faculty, and so far over 10,000 graduates completed various study programmes implemented at the Faculty. Figures 3.3, 3.4 and 3.5 show the total number of students enrolled into Faculty study programmes at undergraduate and graduate level in the academic year 2016/2017.



Figure 3.3 Total number of students enrolled into undergraduate university study programmes in the academic year 2016/2017



Figure 3.4 Total number of students enrolled into undergraduate professional study programmes in the academic year 2016/2017



Figure 3.5 Total number of students enrolled into graduate university study programmes in the academic year 2016/2017

Figures 3.6, 3.7 and 3.8 show the number of students enrolled into the first year of undergraduate university, undergraduate professional and graduate university study programmes for the period of previous five academic years.



Figure 3.6 Number of students enrolled into the first year of undergraduate university study programmes for the past five academic years



Figure 3.7 Number of students enrolled into the first year of undergraduate professional study programmes for the past five academic years



Figure 3.8 Number of students enrolled into the first year of graduate university study programmes for the past five academic years

3.5. SCIENTIFIC AND PROFESSIONAL ACTIVITIES

The Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture is a modern higher education and scientific-research institution focused on the development and application of the latest technology, with the strategic focus of achieving the highest international standards in scientific-research, higher education and professional activities. High standing of the Faculty as scientific-research institution has been confirmed by a number of successful research projects and published scientific papers, as well as cooperation with renowned national and international scientific-research and academic institutions. The results of the scientific activity are presented in over 5000 papers published in high-ranking international journals and conference proceedings within the period of last five years, contributing to the status of the Faculty as one of the country's most research projects and programmes on both national and international level and participates in the activities of scientific centres of excellence, acting as organiser and co-organiser of academic and research conferences on national and international level. The Faculty is also actively involved in processes of knowledge and technology transfer.

		Engin	eering sci	ences	Natural sciences				
	Electrical eng.	Comp.	Mech.	Core eng. sc.	Naval arch.	Physics	Math.	Humanities	Total
Number of researchers	44	13	20	8	3	4	3	3	98
Papers of the highest category *	717	386	224	91	16	1580	18	4	3036
Other papers *	882	236	514	188	58	20	15	43	1956

Table 3.4 Research productivity of the Faculty staff for the period of last five years

Citations**	3359	488	3138	373	7	25869	260	1	33495
Average h-index**	4,8	5,7	3,25	3	1	28,75	4	0,3	5,2
Authorship of scholarly books published abroad	8	9	1	0	0	0	0	0	18
Authorship of scholarly books published in Croatia	2	0	5	5	3	1	1	2	19
Authorship of chapters in scholarly books	21	5	30	2	3	3	1	3	68
Editorship of scholarly books	7	4	6	0	0	0	0	0	17

*Papers listed in accordance with the Regulations on requirements for appointments to academic titles

**Citation data (not including self-citation) and h-index from Scopus

Long-term successful cooperation with the economy resulted in numerous projects, studies, reports and expert reports, as well as long-term scientific and research cooperation agreements with a number of companies and institutions such as: Croatian Electric Power Company (HEP), Ericsson Nikola Tesla, Končar, Siemens, Croatian Telecom, Institute "Hrvoje Požar", Shipyard Split, CEMEX, Light Metals Factory in Šibenik, Split-Dalmatia County, Town of Split, etc. The establishment of joint laboratories was initiated with Croatian Telecommunications - Telecommunication Centre, Split and the company Ericsson Nikola Tesla. Experts in the fields of electrical engineering, mechanical engineering and naval architecture educated at FESB provide a foundation for development of the shipbuilding industry, economic activities based on mechanical engineering, power engineering and particularly the IT sector in the region.

Results of research and project activities are patented solutions and licencing agreements. Below is the list of granted patents:

- Patent Apparatus for increasing efficiency of Slotted ALOHA systems and method thereof, 18446744073709551615, HR
- Patent Iterative Method for Impulse Noise Suppression in OFDM System, 18446744073709551615, HR
- Patent System for controlling users and services on concentration locations with user wireless access, 18446744073709551615, HR
- Patent Virtual Surround for Headphones and Earbuds Headphone Externalization System, 18446744073709551615, CH
- Patent no. P20131030A Control system of wind turbine with hybrid transmission
- Patent no. P20151297 Universal transmission for a systems of power and motion transfer with variable speeds
- Patent Transmission with independently controllable output speed with three planetary mechanisms
- Patent no. P20130009 New type transmissions for converting variable speed control in a constant
- Patent no. P20140292A Turbine-motor regeneration system

• Patent pending – System for DC Link Precharging in Active Front End Frequency Converters, PCT/HR26016/000002

3.6. ACADEMIC AND PROFESSIONAL CONFERENCES

Both independently and in cooperation with other institutions, the Faculty is acting as a principal organiser or co-organiser of a number of research and professional conferences, workshops, summer schools and symposia. Below is the list of most important projects managed, co-managed or assisted by Faculty teaching staff and the list of conferences organised or co-organised by the Faculty.

- International conference on Software, Telecommunications and Computer Networks (SoftCOM),
- International conference LHC days in Split,
- International conference Mechanical Technologies and Structural Materials (MTSM),
- International conference Symposium on Theory and Practice of Shipbuilding,
- International conference Hydrogen on Islands,
- International conference NATO Advanced Research Workshop, Energy options impact on regional security,
- International conference Coupled Methods in Numerical Dynamics,
- International workshop Advanced Ship Design for Pollution Prevention,
- International symposium Green Networking and Computing,
- International symposium Environmental Electromagnetic Compatibility,
- International workshop for the project Progress Mälardalen University, Sweden,
- Workshop Programming of Mobile Robots and Flying Models, organised by the Robotics Association of the Faculty,
- Workshop Robots and Microcontrollers, organised by the Biomechanics and Automatics Association of the Faculty,
- International conference Computational Methods in Electrical engineering and Electromagnetics,
- International conference Boundary Element and other Reduction Methods,
- International conference Accurate Solution of Eigenvalue Problems,
- International conference Heat Transfer,
- International conference Advances in Fluid Mechanics,
- International conference CERN ALICE week,
- International workshop 22nd European Fusion Physics Workshop,
- International conference IEEE Symposium on Computers and Communications.

3.7. INTERNATIONAL COOPERATION

International cooperation is essentially promoted since the founding of the Faculty and is based on the broad global outlook, as well as the awareness that only through international cooperation we are able to trace the progress and spreading of knowledge and ideas and enable knowledge and technology transfer. Cooperation of teaching staff of the Faculty with foreign academic and research institutions is comprehensive and is realized through various international projects and agreements, and especially through individual contacts of teaching staff. During the past years, there has been an increase in mobility of teachers, primarily through the ERASMUS programme. Considerable number of teachers are members of international professional and scientific associations.

As early as 1975, the Faculty established its first cooperation with a foreign research institution through a two-year programme with NASA in the area of CAD technology. Since then, cooperation with foreign scientific and educational institutions is constantly developing. Many Faculty employees were engaged or are still active in a number of projects and have been visiting professors and researchers at international universities and institutes. Below is the list of projects in which the Faculty staff participates either in the role of project stakeholders or researchers.

EU projects

- *Technology transfer infrastructure in the Croatian Adriatic region,* project acronym TTAdria leading project partner: University of Split;
- Research and development of hydrogen energy systems in relation to renewable energy resources, Grant agreement for projects financed from the EU Structural Funds for the programming period 2007-2013. RC.2.2.08-0025;
- Improving safety and efficiency of cogeneration/trigeneration plants, Grant agreement for projects financed from the EU Structural Funds for the programming period 2007-2013. RC.2.2.08-0048;
- European network for innovative uses of EMFs in biomedical applications, COST Action BM1309;
- EUROfusion & ITER WP Code development for integrated modelling;
- COST TU1208: Civil Engineering Applications of Ground Penetrating Radar;
- System automation of PEMFCs with prognostics and health management for improved reliability and economy SAPPHIRE, FP7 Grant agreement 325275;
- Leonardo da Vinci Project DE/12/LLP-LdV/TOI/147538 LOPEC, Lifelong learning programme, FESB and Reutlingen University, Germany;
- Strategic Alignment of Electrical and Information Engineering in European Higher Education Institutions - SALEIE, No. 527877-LLP-1-2012-1-UK-ERASMUS-ENW;
- Establish a Pan-European Information Space to Enhance seCurity of Citizens EPISECC, FP7-SEC-2013-1;
- SPRINT Smart Panels for the Reduction of Noise Transmission;
- HyGuide H2FC-LCA, Development of Guidance Manual for Life Cycle Analysis Application to Fuel Cells and Hydrogen technologies;
- *ME4CataLOgue, Mechanical Engineering for Catalogue, 2013.-2015., GRANT CONTRACT NO.IPA4.1.3.1.06.01.c13; IPA BGUE 04 06;*
- *Creation of the third cycle studies-doctoral studies in metrology,* TEMPUS-159588: Multicounty Joint Project for Curricular Reform 2010-2013.

OBZOR 2020 projects

 GIANTLEAP – Giantleap Improves Automation of Non-polluting Transportation with Lifetime Extension of Automotive PEM fuel cells, FESB, Stiftelsen SINTEF – Norway (coordinator), Universite de Franche-Comte - France, Bosch Germany, ElringKlinger Germany, VDL Bus & Coach Netherlands

- AUTomotive deRivative Energy system (AutoRe) 7 partners: ALSTOM POWER LTD -United Kingdom, ALSTOM (SCHWEIZ) AG - Switzerland, DAIMLER AG - Germany, ELVIO ANONYMI ETAIREIA SYSTIMATON PARAGOGIS YDROGONOU KAI ENERGEIAS -Greece, UNIVERSITA DEGLI STUDI DELLA TUSCIA - Italy, STIFTELSEN SINTEF - Norway and FESB;
- European Atomic Energy Community (Euratom) research and education programme

Bilateral projects

- Dynamic multi-scale analysis of irregular open cell cellular structures, DAAD;
- Networking and modelling of evolutional capabilities of small and large enterprises (Faculty of Mechanical Engineering, Maribor, Slovenia);
- Dynamic strength of thermally cut structural construction elements (bilateral research project with Slovenia);
- DICES Distributed Component-based Embedded Software Systems UKF Unity through knowledge grant (collaborative project: FESB Split - Mälardalen University Sweden - FER Zagreb);
- Electronic monitoring system for prevention of natural disasters (Croatian-Slovenian project partners: DAT-CON, University of Maribor);
- Electromagnetic Interference (EMI) Study of Power Line Communications (PLC) Services (Blaise Pascal University, Clermont-Ferrand);
- Applications of thermography in energy performance inspection and certification (Croatian-Serbian project);
- Internal co-operation agreement concerning the Civil Protection project WIND RISK (FESB and University of Ljubljana);
- Monitored and unmonitored machine learning based on unbalanced data sets as assistance to visually impaired persons (Croatian-Slovenian scientific-research project, FESB and University of Ljubljana, Faculty of Computer Engineering and Computer Science);
- Description of advanced cell materials with variable porosity (Croatian-Slovenian scientific-research project, FESB and University of Maribor, Faculty of Mechanical Engineering);
- Compressed sampling and superresolution in surveillance systems based on optical sensors and drones (Croatian-Montenegrin scientific-research project, FESB and the University of Montenegro, Faculty of Electrical Engineering)

Other international projects

- Compact Muon Solenoid (CMS), collaboration based in CERN; •
- A Large Ion Collider Experiment (ALICE), collaboration based in CERN;
- The MAGIC telescope, collaboration based in La Palma; •
- Joint German-South-Eastern European Network Project ELISE project, collaboration • based in Ilmenau, Germany;
- Marie Curie Actions, Prediction of Electromagnetic fields (PEM), collaboration based • in Hengelo, Netherlands

The Faculty established close and active cooperation with foreign research and teaching institutions, both at institutional and academic level. Letters of Intent for establishing international cooperation agreements have been signed with a number of foreign institutions, e.g.:

- Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung, Germany,
- RHEINISCHE FACHHOCHSHULE KÖLN GGMBH, University of Applied Sciences, Germany,
- Aachen University, Germany,
- Universidade Federal do Rio Grande do Sul, Porto Alegre, Brasil,
- Mälardalen University, Sweden,
- Faculty of Computer Science and Automation of the Ilmenau University of Technology, Germany,
- The University of Nottingham, Great Britain,
- Wessex Institute of Technology, Great Britain,
- University of Travnik, Bosnia and Herzegovina,
- Politecnico di Bari, Italy,
- Blaise Pascal University, Clermont-Ferrand, France,
- Ricardo Software, Detroit Technical Centre, USA,
- AVL LIST GmbH Hans List, Graz, Austria.

It should be noted that extensive network of individual cooperation was established in research that were not formalised by agreements between institutions, or letters of intent. The results of this type of cooperation are presented in a number of relevant papers co-written by the Faculty teaching staff and foreign colleagues. Similar cooperation has been established with the following institutions:

- EPFL, Lausanne, Switzerland,
- University of Magdeburg, Magdeburg, Germany,
- Politecnico di Milano, Milano, Italy,
- ETH- Zurich, Zurich, Switzerland,
- University of Alabama, Birmingham, USA,
- University of Surrey, Guildford, UK,
- University of Ljubljana, Slovenia,
- University of Berkeley, USA,
- University of York, UK,
- Sapienza Università di Roma,
- The Pennsylvania State University.

Both outgoing and incoming student mobility is constantly on the rise and is primarily implemented through ERASMUS student mobility programmes and the IAESTE framework of International Association for the Exchange of Students. Students who complete one part of requirements at a foreign institution are granted full recognition of acquired ECTS credits. For the incoming students in the mobility scheme, teaching is usually organised in the form of consultations with the course teacher.

HAMAG-BICRO projects

• Verification projects of innovative concept-PoC6 Projects: "Modular Integrated Concept of Aluminium Construction of Hybrid Photovoltaic and Thermal Panels for Ventilated Facades"



Figure 3.9 Student mobility for the period of past five academic years

3.8. PUBLISHING ACTIVITIES

Due to the lack of adequate textbooks in expert engineering areas, since its establishment, FESB has devoted considerable attention to the development of teaching materials. FESB has published a series of textbooks, lecture notes, handbooks with tasks and instructions for laboratory exercises. So far, within its own publishing activities, Faculty has published 17 university books and 18 collections of lecture notes. During the previous planning period, between 2012 and 2016, independent publishing department of FESB published 33 titles: 3 university textbooks, 3 collections of lecture notes, 6 printed collections of academic papers and 21 collections of academic papers in e-format.

Since 2005, in collaboration with the Association for Communication and Information Technology, the Faculty has been publishing an academic periodical publication titled *Journal of Communications Software and Systems*, currently indexed in SCOPUS database and supported by international association IEEE (Institute of Electrical and Electronics Engineers. Academic journal *International Journal for Engineering Modelling*, also indexed in Scopus, is co-published by FESB and the Faculty of Civil Engineering, Architecture and Geodesy of the University of Split.

4. MISSION

The Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture in Split is a higher education and research institution focused on the development and application of modern technology, with the strategic focus of achieving the highest international standards in research, higher education and professional activities. FESB is a research and teaching constituent part of the University of Split, educating quality experts in the field of engineering, that is, in the scientific areas of Electrical Engineering, Computing, Mechanical Engineering, Naval Architecture and basic engineering sciences. This is achieved through a continuous improvement of teaching facilities, the application of modern teaching methods and through scientific research. Therefore, experts educated at FESB are able to contribute to the development of the Croatian economy.

FESB adjusts its activities to modern world trends in the development of scientific research, professional and educational activities. This particularly refers to a continuous and systematic improvement of all the following areas: the establishment, the organization and the implementation of study programmes; the increased efficiency in the educational and scientific-research process; connecting educational, scientific and professional activities, as well as establishing and improving internal organization. FESB actively cooperates with scientific, higher education and economic partners in Croatia and abroad. The Faculty provides opportunities for the incoming and outgoing mobility of students and teachers. Also, it ensures the rational use of human and material resources, as well as the development of scientific and teaching activities, and professional work in the field of engineering and natural sciences.

5. VISION

FESB will continue to be in coordination with its mission and will direct its development towards the establishment of an educational and scientific research centre of excellence in the field of engineering sciences, that is, in the subject areas of Electrical Engineering, Computing, Mechanical Engineering, Naval Architecture, in the basic engineering technical sciences, and in the field of natural sciences, particularly in the subject areas of Mathematics and Physics. The task of the Faculty is to retain its status as one of the leading higher education institutions and as one of the leading scientific research institutions in the above mentioned areas in the Republic of Croatia, constantly aspiring to reaching European standards in teaching and research productivity.

FESB provides quality services in higher education and scientific research and encourages active participation in the European higher education and research area. It will also link the educational process with scientific research and the economy through its active involvement in scientific and technological projects. At the same time, it will actively encourage cooperation with other educational institutions, institutes and expert practitioners.

6. SWOT ANALYSIS

During the 57 years since it was founded, the Faculty has achieved impressive results which have contributed to its affirmation as a leading scientific and higher education institution in the region and one of the most significant institutions in Croatia. Prerequisite for adopting an effective development strategy is analysis of the current situation and results achieved in the previous strategy. This relates to the consideration of external and internal factors in order to determine the best way to achieve the desired strategic goals.

SWOT analysis is qualitative analytical method based on four parameters (strengths, weaknesses, opportunities and threats) that serve to assess the current situation and extrapolate future situations taking into account the internal conditions and external environment. Accordingly, SWOT analysis shows external opportunities, inner strengths and weaknesses of the organization, but also dangers that the Faculty faces. Chronologically, the strengths and weaknesses are indicators of the past, i.e. they indicate searching for the causes of the current situation, while opportunities and threats represent a possible future image based on the current state that is dependent on conditions from the past.

Strengths/Advantages:

- Tradition and recognizable identity,
- Human resources,
- Recognisable individual research groups,
- Space facilities,
- Computer equipment,
- Potential for interdisciplinary research,
- Well-established postgraduate studies.

Weaknesses/Disadvantages:

- Lack of research and teaching staff in certain fields,
- Insufficient number of international research projects,
- Insufficient number of technological projects,
- Teachers with scientific-educational titles are overloaded with teaching and in particular with administrative duties,
- Formal and legal procedures and limitations imposed in connection with employment of new staff,
- Lack of a comprehensive system for awarding Faculty staff,
- Low mobility of teaching and non-teaching staff,
- Activities and organisation of library are not harmonised with the needs of the Faculty,
- Low exam passing rates among certain study groups,
- Small number of foreign students,
- Absence of mechanisms for systematic and continuous harmonization of study programmes with the demands of the commercial and industrial sector,
- Low interest in postgraduate university (doctoral) studies,
- Enterprises in the area show low level of interest in research,

- Lack of interdisciplinary research,
- Marketing,
- Influence of the Faculty extended over the University level is not proportionate to its size and significance.

Opportunities/Options

- The Faculty tends to increase the number of enrolled students with better grades in high school,
- Predictable demand for graduate engineers in the future,
- Applications for projects financed by the European Union,
- Better cooperation with economic operators,
- Better scientific connections with other universities and research institutes,
- Attractive geographical location,
- Initiation of different lifelong learning programmes.

Threats/Fears:

- Insufficient funds for scientific research from government and private funding, as well as from foundations,
- Questionable and insecure way of financing higher education,
- Unstable legal framework with regulations that change frequently,
- Insufficient installation grants to fund research projects which would stimulate young researchers,
- Limited staff employment opportunities at the Faculty, especially for graduates of doctoral studies, at the same time, low absorptive capacity of enterprises in the region (the motivation for the recruitment of excellent students for the positions of junior researchers),
- Unfavourable economic structure insufficient promotion of knowledge-based economy.

7. STRATEGIC GOALS, TASKS, INDICATORS AND STRATEGY BENCHMARKS

In the process of identifying strategic goals and tasks, specific role of the Faculty as a public institution largely financed from the state budget was taken into consideration. The core activities of the Faculty fall under three main categories: (1) teaching activities, (2) scientific-research activities (3) and professional activities. Correspondingly, the Strategy has been created according to these groups, allowing more effective monitoring, analysis and evaluation of achievements. For each of these activities, strategic goals and activities, international cooperation was reviewed separately, since the plan for the following period is to emphasise the importance of strengthening of international cooperation and international standing of the Faculty. As the culture of quality is fostered in all Faculty activities, strategies, a strategy of resource development is prepared, in terms of material, financial and human resources.

7.1. STUDENTS AND TEACHING ACTIVITIES

Students and teachers represent the greatest value of the Faculty, and the Faculty's primary function is to educate young professionals who will become bearers of economic development through their knowledge, skills and competences, and eventually become the driving force behind economic and overall development of our region and country. The Faculty will provide its users with quality services in the field of higher education, ensure and develop all aspects of education and encourage active participation in the European higher education area. International aspects of study programmes will be encouraged, in terms of creating and implementing study programmes in English (e.g. graduate university study programme in Computing and other programmes). It is necessary to provide equal access to studies, in accordance with the competences of the candidates. In addition, it is also necessary to increase the system efficiency, leading to shorter completion time for a degree and increase in success rate.

Strategic goal 1: Quality and efficient education based on learning outcomes, flexible learning paths and lifelong learning, in accordance with the needs of the community, economy and development of the society.

Providing education based on learning outcomes at university undergraduate, graduate and postgraduate studies and professional undergraduate studies is realized through the following tasks.

TASK 1.1.	Review of study programmes and harmonising the actual student workload with ECTS credits awarded for individual courses
DESCRIPTION	Following trends in the development of higher education in the area of engineering sciences and reviewing and improving study programmes based on surveys conducted with teachers, students, former students and employers
IMPLEMENTATION	Committees for study programmes, Vice Dean for education
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Adopted forms for amendments of the study programmes. Number of reviewed study programmes or harmonised courses.

TASK 1.2.	Prepare study programmes for entry into CQF register.
DESCRIPTION	Study programmes must have clearly defined and verifiable learning outcomes arising from hierarchy of sets of learning outcomes at the level of study programmes concerning individual courses. Based on the sets of learning outcomes, the application is prepared for their entry into CQF register.
IMPLEMENTATION	Committees for study programmes, Quality Enhancement Committee, Vice Dean for education.
IMPLEMENTATION PERIOD	December 2020
IMPLEMENTATION INDICATORS	Application for entry of sets of learning outcomes into CQF register.

TASK 1.3.	Initiating graduate university studies taught in English language.
DESCRIPTION	Initiate a pilot project of implementing the existing graduate university study programme in Computing taught in English, during the academic year 2018/2019. The study programme would be implemented based on the existing programme, in Croatian and English. The admission quota would be divided, to allow admission to the programme taught in English both to the foreign students and students who completed the undergraduate university study in Computing at FESB. In case the pilot projects shows that the faculty offers necessary capacity, other graduate study programmes taught in English would be initiated.
IMPLEMENTATION	Management, Committees for study programmes in Electrical Engineering and Computing, Quality Enhancement Committee
IMPLEMENTATION PERIOD	October 2018
IMPLEMENTATION	Students enrolled to the graduate university study programme in Computing
INDICATORS	taught in English; implementation plan adopted.

TASK 1.4.	Continuing professional development of teachers in workshops and seminars to acquire competences for outcome-based teaching.
DESCRIPTION	Organise continuing professional development courses for teachers in educational, instructive, methodological and other areas, to acquire competences for outcome-based teaching.
IMPLEMENTATION	Vice Dean for education
IMPLEMENTATION PERIOD	December 2018
IMPLEMENTATION INDICATORS	Held seminars and workshops on learning outcomes for teachers.

TASK 1.5.	Analysis of passing rate, reaching conclusions and adopting measures for increasing the passing rate.
DESCRIPTION	Regularly collecting and analysing data on student progression and the number of students dropping out, and adopting measures for increasing the ratio of successful students.
IMPLEMENTATION	Quality Enhancement Committee, Vice Dean for education.
IMPLEMENTATION	Continually

IMPLEMENTATION	Annual analysis reports.
INDICATORS	
	Development and improvement of teaching laboratories and IT
TASK 1.6.	infrastructure.
DESCRIPTION	Analyse needs of departments for purchase of laboratory equipment and IT equipment. Analyse multi-annual procurement plan for IT equipment. Securing financial resources based on the annual financial plan and procurement plan and updating teaching laboratories and IT infrastructure.
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Annual amount of financial resources invested in purchase of laboratory and IT equipment.
TASK 1.7.	Providing educational programme for teaching staff for preparing e-courses.
DESCRIPTION	Organising workshops, courses and seminars given by reputable experts in the field of e-learning with the aim of developing competences of teachers for preparing and implementing e-courses. Provide financial and organisational assistance to teachers in developing innovative and quality e- courses.
IMPLEMENTATION	Vice Dean for education
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION	Reports on conducted workshops, courses and seminars. Number of
INDICATORS	accepted e-courses with the share of e-learning of over 50 %.
TASK 1.8.	Encourage teachers to publish textbooks and teaching materials.
DESCRIPTION	Provide financial assistance (paying for reviews and proofreading) and organisational assistance to teachers in developing and publishing textbooks and teaching materials.
IMPLEMENTATION	Management
IMPLEMENTATION	Continually
	Number of published textbooks and teaching materials
INDICATORS	Number of published textbooks and teaching materials.
TASK 1.9.	Encourage teachers to organise and implement lifelong learning programmes.
DESCRIPTION	Provide organisational assistance to teachers in applying new summer school modules, CPD courses, excellence centres and differential programmes for acquiring competences for admission into graduate university study programmes.
IMPLEMENTATION	Management, Coordinator of FESB Summer School
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION	Number of proposes summer school modules and number of students

of students in differential programmes.

TASK 1.10.	Encourage teachers to organise and implement project-oriented learning.
DESCRIPTION	Project-oriented learning facilitates integration of development of competences by correlation of several courses and several teachers on a joint project. Organising seminars and workshops will enable the teachers to recognise the advantages of this type of teaching.
IMPLEMENTATION	Management
IMPLEMENTATION	Continually
PERIOD	
IMPLEMENTATION	Number of seminars and workshops. Number of projects and project-
INDICATORS	oriented courses.

TASK 1.11.	Stronger promotion of FESB with the aim of attracting successful high school graduates
DESCRIPTION	Promote the Faculty in the media and through popular science lectures and workshops, open day events and similar activities, with the aim of raising awareness of the research and scientific potential and study programmes of the Faculty, with the aim of attracting successful high school graduates.
IMPLEMENTATION	Management
IMPLEMENTATION	Continually
PERIOD	
IMPLEMENTATION INDICATORS	Number of popular science lectures and workshops held by teachers in secondary and primary schools and at the Science Festival. Number of media appearances of teachers and students in relation to popular science. Organisation of open day event.

Strategic consideration of the Faculty is to provide quality and effective education harmonised with the needs of the community, economy and the overall development of the society, therefore the Faculty continually invests efforts in order to ensure all necessary conditions for quality and effective education. We make an effort to provide well-prepared study programmes, highly educated teachers, suitable facilities and equipment in combination with good organisation and constant care for student progression with the aim of increasing the number of students who complete their studies in time and acquire competences necessary for entering the labour market. The Faculty is paying attention to the students' standard of living and studying by ensuring the necessary infrastructure and providing support to students' social, cultural and sports activities. Special support is provided to students with disabilities, enabling access to all Faculty resources and making adjustments to the teaching activities.

Strategic goal 2: Ensure pleasant and motivating environment for quality and effective studying, taking into account the basic principle of equal opportunities for all students.

The Faculty will pursue the goal of providing support to the conditions of studying and the students' standard of living in the following tasks.

TASK 2.1.	Providing support to social, cultural and sports activities of students.
DESCRIPTION	Provide financial and organisational support to students' extra-curricular activities. Ensure material conditions for recreational and sports activities. Provide financial support to various types of students' competitions (International competition of electrical engineering students "Elektrijada", University sports competitions).
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Number of activities and granted financial resources for every academic year.

TASK 2.2.	Providing support to student associations.
DESCRIPTION	Establishing partnership and organising regular meetings with the Student Assembly with the aim to resolve any issues related to studying or the students' standard of living. Ensure space for student associations. Provide financial support to the activities of the Students assembly and student associations.
IMPLEMENTATION	Management, Student Assembly
IMPLEMENTATION	Continually
PERIOD	
IMPLEMENTATION	Conclusions from the meetings of the Management and Student Assembly.
INDICATORS	

TASK 2.3.	Enable unrestricted and pleasant work for students with disabilities.
DESCRIPTION	Improve and facilitate access to all Faculty resources to students with disabilities. Adapting the teaching activities and testing of knowledge, skills and abilities to students with disabilities. Encourage volunteer work and peer support.
IMPLEMENTATION	Management
IMPLEMENTATION	Continually
PERIOD	
IMPLEMENTATION	All physical resources of the Faculty accessible to students with disabilities.
INDICATORS	

7.2. RESEARCH ACTIVITIES

Scientific-research activities represent the foundation of the faculty and for that matter, any faculty or university institution, and at the international level the faculty's most recognisable feature is its research productivity. The Faculty has an exceptional scientific potential which needs to be motivated and directed towards becoming recognized not only in the Republic of Croatia, but also in the wider region, aiming at becoming one of the initiators of technological development and economic growth of the local community and Croatia. The Faculty actively collaborates with the scientific and economic partners at home and abroad aiming at becoming one of the leading scientific-research institutions in the field of engineering sciences in the Republic of Croatia. The Faculty also needs to attain international standing, at least in some research groups. It is necessary to strengthen research capacities

and provide support to applications of international projects in order to increase the number of international projects with Faculty researchers as leaders or associates.

Special attention should be directed at advancing the research work at the levels of graduate and postgraduate studies and including the students of university studies in the process of scientific-research work. Within the framework of scientific-research activities the aim is to ensure the conditions for: increasing the level of innovation and technological competitiveness, encourage creating innovations and ensure their successful commercial application, increase the number and quality of patents and innovations, encourage starting knowledge-based companies.

Strategic goal 3: The Faculty FESB is a scientific-research institution oriented towards the development and application of modern technologies, but it is also a starting point for the creation of new scientific ideas and their implementation in the economy.

Strategic programmes of scientific research with research topics, research programme and specific goals for each topic is presented in detail in the following chapter of this document. Strengthening of scientific research activities of the Faculty as the focal point of research excellence of the Faculty in the area of engineering and natural sciences is realized in the following tasks.

TASK 3.1.	Promoting research productivity and international standing.
DESCRIPTION	Through multi-annual financing of research activities and co-financing of mobility of researchers strengthen Faculty support to their participation in international projects in order to increase the number of published scientific papers in renowned international publications.
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Number of co-financed mobility of researchers. Number of published papers.

TASK 3.2.	Review of postgraduate study programmes and grouping courses by theme.
DESCRIPTION	Based on the recommendation of the reaccreditation commission for postgraduate university studies, for each academic year the committees will propose grouping courses by theme.
IMPLEMENTATION	Committees for postgraduate studies, Vice Dean for science
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Adopted list of courses by groups.

TASK 3.3.	Procuring additional sources of funding for scientific-research projects.									
DESCRIPTION	Strengthen Faculty support in applying for international projects and projects implemented in cooperation with the economic and social community.									
IMPLEMENTATION	Management									
IMPLEMENTATION	Continually									

IMPLEMENTATION INDICATORS	Number of submitted applications for international and national scientific- research projects.							
INDICATORS	Encourage participation of undergraduate and graduate students in the							
INDICATORS	Encourage participation of undergraduate and graduate students in the							
	Encourage participation of undergraduate and graduate students in the							
	Encourage participation of undergraduate and graduate students in the							
TASK 3.4.	scientific-research activities.							
DESCRIPTION	Students at undergraduate and graduate levels participate in different ways in scientific-research activities, in order to introduce them to the research methodology and ethical principles in science – through organisation of popular science lectures, co-financing of student associations and projects and final and diploma thesis which are based on scientific-research projects. Publish scientific papers with students as co-authors with the aim of presenting the methodology of writing scientific papers to the students.							
IMPLEMENTATION	Management							
IMPLEMENTATION	Continually							
PERIOD								
IMPLEMENTATION	Number of published scientific papers with undergraduate and graduate							
INDICATORS	students as co-authors. Number of popular science lectures.							
TASK 3.5.	Promote organisation of international academic conferences.							
DESCRIPTION	Provide financial and organisational support to organisation of international academic conferences, with the aim of improving the international standing of the Faculty.							
IMPLEMENTATION	Management							
IMPLEMENTATION	Continually							
PERIOD								
IMPLEMENTATION	Number of organised conferences.							
INDICATORS								
TASK 3.6.	Producing and improving academic journals.							
DESCRIPTION	Ensure financial and infrastructural support for producing at least one more academic journal in the field of engineering sciences and take all necessary measures to have the existing academic journals co-published by the faculty indexed in WoSCC (<i>Web of Science Core Collection</i>) databases.							
IMPLEMENTATION	Management							
IMPLEMENTATION	Continually							
PERIOD								
IMPLEMENTATION	Number of produced academic journals. Indexing of existing journals in							
INDICATORS	WoSCC databases.							
IMPLEMENTATION IMPLEMENTATION PERIOD	Ensure financial and infrastructural support for producing at least one more academic journal in the field of engineering sciences and take all necessary measures to have the existing academic journals co-published by the faculty indexed in WoSCC (<i>Web of Science Core Collection</i>) databases. Management Continually							

7.3. COOPERATION WITH THE ECONOMY, COMMUNITY AND THE SURROUNDINGS

Economic development as well as the development of society as a whole is part of the main tasks of the Faculty. A part of research activities at the Faculty is systematically and structurally focused towards fundamental, developmental and applied research for the needs of the economy and social community. As an institution with a large number of highly educated professionals in the field of engineering sciences, the Faculty fosters and encourages the participation of its experts in professional activities, both in the region and in the wider environment. Study programmes at the Faculty are based primarily on the needs of the economy which is included in the study programmes in several ways: students complete one part of course requirements (final and diploma thesis and professional practice) in companies, and experts from the private sector participate in teaching activities of the Faculty.

Strategic goal 4: The Faculty, as the leading institution in the area of engineering sciences in the region, continually and systematically contributes to the development of the economy and the community.

The Faculty fulfils its role as the driving force behind the economic and social development through the following tasks.

TASK 4.1.	Promoting cooperation with the Associations of former students of FESB (Alumni).
DESCRIPTION	Organise regular meetings with the Association of former students of FESB. Creating database on members of the Association. Include the members in advisory role in the process of reviewing current study programmes and adopting new study programmes. Receiving feedback on quality of studies.
IMPLEMENTATION	Management
IMPLEMENTATION	Continually
PERIOD	
IMPLEMENTATION INDICATORS	Database on members of the Association. Minutes from held meetings.

TASK 4.2.	Promoting cooperation and strengthening of partnership with economic operators and the community.
DESCRIPTION	Organise meetings with the economic operators and local community and formalise the forms and the areas of cooperation.
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Number of signed agreements.

TASK 4.3.	Encourage students and employees to become involved in all aspects of community activities.
DESCRIPTION	Promote cooperation with associations involved in civil society projects, with the aim of increasing the number of students and employees with acquired practical knowledge and skills in solving actual problems in the community and contributing to the development of the community. Encourage volunteering activities of students and Faculty staff.
IMPLEMENTATION	Management
IMPLEMENTATION	Continually
PERIOD	
IMPLEMENTATION	Number of signed agreements, project applications and volunteering
INDICATORS	projects

TASK 4.4.	Encourage cooperation with companies – work-based learning centres with organisation of students' professional practice.
DESCRIPTION	Creating connections with the companies, signing work-based learning centres agreements, organising students' professional practice in agreement with companies.
IMPLEMENTATION	FESB work-based learning centres coordinator
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Number of signed agreements, number of students who completed professional practice during the academic year

7.4. INTERNATIONAL STANDING

During the upcoming period it is necessary to place even greater emphasis on international cooperation and participation in international projects accessible through international research projects competitions and funds. Globalisation of higher education undoubtedly brings many benefits: primarily flow of information and ideas, exchange of opinions and experiences and learning about examples of best practice.

International cooperation should be maintained and developed based on existing cooperation agreements and new agreements, and especially through participation in exchange programmes, joint organisation of academic conferences, summer schools, joint project implementation, co-publishing of journals and academic publications, cooperation in implementing parts of undergraduate, graduate and doctoral studies and student and teacher exchange programmes.

Strategic goal 5: Strengthening international standing of the Faculty.

The Faculty will improve its international standing through the following tasks.

TASK 5.3.	Encourage outward mobility of students and Faculty staff.
DESCRIPTION	Continue with co-financing students' outward mobility and introduce similar co-financing of staff outward mobility. Prepare co-financing programme and financial plan.
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Number of students and employees in outward mobility programmes.
TASK 5.4.	Encourage inward mobility of students and researchers.
	Enable inward mobility students in ERASMUS programme to participate in all
DESCRIPTION	placement at the Faculty through student association IASTE, in accordance with available financial resources. Ensure adequate working space and equipment to guest researchers.
DESCRIPTION	placement at the Faculty through student association IASTE, in accordance with available financial resources. Ensure adequate working space and equipment to guest researchers. Management
DESCRIPTION IMPLEMENTATION IMPLEMENTATION PERIOD	teaching activities. Continue financing of a number of students on work placement at the Faculty through student association IASTE, in accordance with available financial resources. Ensure adequate working space and equipment to guest researchers. Management Continually

7.5. QUALITY ASSURANCE SYSTEM

Quality assurance and establishing institutional mechanisms for continuous improvement of education, scientific and professional work are a task, duty and responsibility of management, teachers and associates, students and all employees of the Faculty. In this regard, it is necessary to encourage and support the functioning of all mechanisms of quality assurance system in all areas and through all legal documents of the Faculty. The Faculty is actively and consistently concentrated on permanent improvement of quality of its overall teaching, scientific-research and professional activities, taking into account national and international standards and combining previous experiences and all activities which have so far contributed to Faculty's ranking as one of leading higher education institutions in Croatia.

Quality assurance policy of the Faculty is assessed by internal and external audits. In addition to regular internal audits, in the past period of five years, two re-accreditation procedures were conducted at the Faculty:

- In the course of 2012, institutional reaccreditation was conducted by the Agency for Science and Higher Education (ASHE) and
- In the course of 2016, thematic re-accreditation of postgraduate (doctoral) studies was conducted, also by the Agency for Science and Higher Education (ASHE).

For both re-accreditation procedures, in addition to standard obligatory documents and regulations, detailed self-evaluation reports were prepared, based on which international expert commissions conducted re-accreditation procedures. Both re-accreditation procedures were successfully completed. Based on institutional re-accreditation, ASHE submitted to the Faculty the Accreditation recommendation on fulfilment of conditions for higher education and research activities. In the procedure of thematic re-accreditation of

postgraduate (doctoral) studies, ASHE submitted to the Faculty the Accreditation recommendation on fulfilment of conditions for this activity, with high quality level indicator.

As one of the leading research and higher education institutions in Croatia, the Faculty is selected as one of the participants of the higher education quality assurance and quality enhancement project in Croatia. Within its framework, pilot project for re-accreditation of seven higher education institutions in accordance with the new Standards and guidelines for quality assurance in the European Higher Education Area (ESG, 2015). Therefore, by the end of 2017 it would be necessary to prepare the self-evaluation report in Croatian and English and prepare for the visit of the international re-accreditation commission in the beginning of 2018.

Quality assurance system of the Faculty is an integral part of the quality assurance system of the University, and is based on the following documents:

- 1. University of Split Statute,
- 2. University of Split Code of Ethics,
- 3. Regulations on organisation and role of the Quality Assurance System at the University of Split,
- 4. Faculty Statute,
- 5. Code of conduct for Faculty staff,
- 6. Faculty Code of Ethics,
- 7. Regulations on quality enhancement system of the Faculty,
- 8. Faculty Quality Assurance Handbook,
- 9. Rules of procedure of the Faculty Council and department councils,
- 10. Regulations on job classification,
- 11. Regulations on studies and studies system of the Faculty,
- 12. Regulations on student disciplinary procedures,
- 13. Regulations on assessing work performance of assistants, postdoctoral researchers and supervisors.

Strategic goal 6: Quality assurance system is an integral part of all Faculty activities, involving all its stakeholders.

The Faculty will create and foster the culture of quality through the following tasks.

TASK 6.1.	Conduct and promote all activities which serve to conform the quality assurance system with national and ESG standards.											
DESCRIPTION	Adopting and monitoring the implementation of strategic documents based on specified indicators and publishing of those documents. Harmonisation of legal acts with regulations and University documents. Conducting activities for quality assurance and enhancement established in the Quality Assurance Handbook.											
IMPLEMENTATION	Quality enhancement committee, Commission for internal audit, Management											
IMPLEMENTATION PERIOD	Continually											

IMPLEMENTATION INDICATORS	Adopted and published Development Strategy and legal acts of the Faculty. Adopted and published action plans and implementation of plans. Adopted performance reports of Quality enhancement committee and Commission for internal audit.
TASK 6.2.	Preparation and drafting of self-evaluation report within the framework of re-accreditation pilot project.
DESCRIPTION	In accordance with the new Standards and guidelines for quality assurance in the European Higher Education Area (ESG, 2015) and national standards and legal regulations, it is necessary to prepare the Faculty self-evaluation report and prepare for the visit of the re-accreditation commission.
IMPLEMENTATION	Management, Quality enhancement committee, Commission for internal audit
IMPLEMENTATION PERIOD	December 2017
IMPLEMENTATION INDICATORS	Adopted Faculty self-evaluation report.

7.6. HUMAN, FINANCIAL AND MATERIAL RESOURCES

In addition to its students, Faculty employees represent the greatest value of the Faculty. In order to respond to the challenges of the 21st century, it is necessary to foster and develop competences of all those who participate in scientific-research, teaching and administrative activities of the Faculty. Large number of employees and students has significant potential, not only for the faculty and the University, but also for the town and the region. It is the task of the Faculty to enable the students and the Faculty staff to use their time and efforts effectively, contributing both to individual gain and to the advantage of the Faculty.

Strategic goal 7: Devoting close attention to the number of employees, their motivation and the quality of their work.

The Faculty will take due care of the number of employees, their motivation and job satisfaction through the following tasks.

TASK 7.1.	Harmonise human resources policy with actual needs and development plans.
DESCRIPTION	Prepare an employment plan for new teachers, taking into consideration the teaching workload, with the aim of decreasing teaching workload while taking into account the research productivity.
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Adopted employment plan and annual report on teaching workload.
TASK 7.2.	Encouraging development of competences of all employees.

DESCRIPTION	Organising courses, workshops and lectures or guiding the staff to attend										
	such	activities	outside	the	faculty	, with	the	aim	of	advancing	the

	competences of all Faculty staff in their special areas.
IMPLEMENTATION	Management
IMPLEMENTATION	Continually
PERIOD	
IMPLEMENTATION	Number of employees who participated in some form of professional
INDICATORS	development.
TASK 7.3.	Awarding assistants and postdoctoral researchers.
DESCRIPTION	Organise presentations of the research work of assistants and postdoctoral researchers through internal call for project proposals. The proposals will be judged by peer applicants, expert commission and representatives of companies. The best proposals will be awarded and the funds will be used to develop the project proposal.
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Number of received project proposals. Number of awards.
TASK 7.4.	Provide cultural, sports and other activities of the staff.
DESCRIPTION	Enable preconditions for inclusion of as many employees in cultural, sports and other free-time activities. Maintain permanent contact with union representatives and in cooperation with them seek to improve living and working conditions at the Faculty.
IMPLEMENTATION	Management, Union branch
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Number of employees participating in sports, cultural and other free-time activities supported or organised by the Faculty.

As a public institution, the Faculty is financed from the state budget and from its own resources (income earned at the free market). Since the state funding does not cover regular operating costs, it is necessary to seek new modes of financing to increase income and ensure continuous work and development of the Faculty.

Strategic goal 8: Ensure rational operations and optimal spending of resources in accordance with plans, while trying to increase the share of own resources in Faculty income.

Optimal and transparent spending of resources and increase the share of own resources will be realised through the following tasks.

TASK 8.1.	Encourage all activities within the scope of work of the Faculty with the aim of increasing the share of own resources in Faculty income.
DESCRIPTION	Establish contacts and maintain relationships with economic operators and institutions of local government and self-government and earn additional income from core activities within the scope of work of the Faculty, through participation in joint projects.

IMPLEMENTATION	Management
IMPLEMENTATION	Continually
PERIOD	
IMPLEMENTATION	Number of signed agreements and contracts. Annual report on share of own
INDICATORS	resources in total Faculty income.
TASK 8.2.	Rational and transparent spending of resources.
DESCRIPTION	Based on published annual financial plan and procurement plan, make rational investments in facilities and research and teaching equipment.
IMPLEMENTATION	Management
IMPLEMENTATION	Continually
IMPLEMENTATION PERIOD	Continually

The Faculty ensures all necessary resources for high-quality teaching and scientific-research activities, with special attention focused at well-equipped laboratories and access to scientific information. In order to maintain the present-day level and follow technological advances and current teaching and research trends, it is necessary to continually invest and modernise the research and teaching infrastructure.

Strategic goal 9: Continuous improvement and development of the Faculty's material resources in order to enable a high quality work environment and to ensure the best conditions for conducting teaching, scientific-research and professional work.

Improvement and development of infrastructure will be realised through the following tasks.

TASK 9.1.	Equip the facilities of the Faculty with the aim of creating favourable working and studying conditions.
DESCRIPTION	Based on the annual plan, maintain and renovate the building and purchase necessary equipment and devices.
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	Continually
IMPLEMENTATION INDICATORS	Annual report on renovation of facilities and purchase of equipment and devices.
TASK 9.2.	Establishing computer centre in cooperation with SRCE (University Of Zagreb University Computing Centre).
DESCRIPTION	In cooperation with the University and SRCE, construction of a computer centre at the Faculty with the aim of consolidating and advancing the Faculty IT structure.
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	December 2019
	Constructed and functional computer centre.

TASK 9.3.	Improving energy efficiency level of the Faculty building
DESCRIPTION	Building A of the Faculty was constructed in 1980, and due to planned improvements in energy performance of the building, it is necessary to renovate the façade and replace the carpentry. The Faculty will apply for funding from special funds for co-financing the activities of improving energy efficiency level.
IMPLEMENTATION	Management
IMPLEMENTATION PERIOD	December 2021
IMPLEMENTATION	Decrease in utility expenses of the Faculty.

8. STRATEGIC PROGRAMME OF SCIENTIFIC RESEARCH

Having a significant research potential in the area of engineering and natural sciences, the Faculty founded its strategic programme of scientific research on long term experience and in accordance with the relevant strategic documents, principally EUROPA 2020 strategy for smart, sustainable and inclusive growth and Smart specialisation strategy of the Republic of Croatia for the period from 2016 to 2020. In accordance with the strategic aims defined in these documents, the Faculty establishes priorities in research related to energy sources (with emphasis renewable energy sources, especially solar and wind energy), energy efficiency and environmental issues, information and communication technologies, biomedical engineering, machine engineering, basic engineering sciences and naval architecture. In accordance with this, the Faculty places the focus of scientific research with topics, programme and research goals as presented in Table 8.1.

Research topic 1	Energy efficiency and renewable energy sources
Work programme for topic 1	 Analysis of power systems with a high share of renewable energy source and the detection of potential problems Development of advanced methods and algorithms for the planning of a power system and its subcomponents under conditions of high integration of renewable energy sources The proposal of new algorithms and modifications of existing operating procedures and policies which would enable normal operation of the system with high integration of renewable energy sources at minimal costs Optimization of grid-connected photovoltaic systems with battery storage Analysis of overvoltage related to renewable energy sources Optimization of hydropower plants exploitation in market conditions
Topic 1 research goals 1	 Developed and implemented algorithm for the planning of a power system and its subcomponents under conditions of high integration of renewable energy sources Developed algorithm for optimization of grid-connected photovoltaic systems with battery storage Proposed solutions for decreasing overvoltage related to renewable energy sources Developed algorithm for optimization of hydropower plants exploitation in market conditions
Research topic 2	Advanced numerical modelling of electromagnetic phenomena in electric power systems
Work programme for topic 2	 Development of time-harmonic and transient electromagnetic models of grounding systems Development of advanced numerical models for computation of electric and magnetic fields of power lines and substations Development of electromagnetic model for computation of ground fault current distribution Advanced modelling of the proximity effect Advanced modelling of the external thermal resistance
Topic 2 research goals	 Development of time-harmonic and transient electromagnetic models of grounding systems Development of advanced numerical models for computation of electric and

Table 8.1 Topics, programme and research goals

	 magnetic fields of power lines and substations Development of electromagnetic model for computation of ground fault current distribution Advanced modelling of the proximity effect Advanced modelling of the external thermal resistance
Research topic 3	Smart grid metrology infrastructure
Work programme for topic 3	 Development of device for calibration of non-sinusoidal voltage and current Measuring of harmonics and flickers in EPS Measuring of power and energy which is caused by high harmonics in EPS Development of the algorithm for recognizing faults and events in EPS based on measurement of collected data
Topic 3 research goals	 Constructed laboratory model of device for calibration of non-sinusoidal voltage and current Developed device for measuring of harmonics and flickers in EPS Developed algorithm for measuring of power and energy which is caused by high harmonics in EPS Developed algorithm for recognizing faults and events in EPS
Research topic 4	Power electronics converters in renewable energy systems
Work programme for topic 4	 Development of advanced regulatory systems with asynchronous machines Development of advanced regulatory systems with switched reluctance machines Development of algorithms for optimisation of converter operating point Development of the converter model with included nonlinearities Development of frequency converters for high speed electric machines Optimization of losses for high speed electric drives Development of control algorithms for frequency converters Simulation and development of optimal control algorithm of active power filter
Topic 4 research goals	 Regulatory system with asynchronous machine and switched reluctance machine developed and implemented in laboratory conditions Algorithm for optimisation of converter operating point developed and implemented in laboratory conditions Developed converter model with included nonlinearities Developed control algorithm and frequency converter for high speed electric machines Developed control algorithm of active power filter with minimum losses and minimum harmonic distortion
Research topic 5	Research in the field of new information and communication technologies including wireless communications, advanced network technologies, cloud computing, communication between machines and humans and security aspects
Work programme for topic 5	 Development of efficient algorithms for information processing Development of efficient methods for heterogeneous network design Development of methods and models for security analysis of cognitive authentication protocols Development of user-friendly protection against relay attacks in the context of ATM transactions Development of advanced architectures and protocols for heterogeneous networks Development of system prototypes for predictive Bayesian data processing Development of methods and algorithms for improving energy efficiency of communication networks Development of the statistical model of the communication processes
Topic 5 research goals	Advanced authentication protocols and models for IoT

	 Developed predictive models of multimedia ICT systems Developed system prototypes for predictive data processing
	Proposed new efficient systems based on RFID technology.
Research topic 6	Application of information and communication technologies in environment protection and forecasting, control and disaster risk management
Work programme for topic 6	 Analysis and development of segmentation and classification of regions on natural landscape images Development of detection methods of hardly detectable features and objects on real-time sequences of images Development of fast procedures for 3D terrain modelling Application of FPGA platform in fast image processing Application and development of artificial neural networks in image processing Analysis and development of procedures for transfer of HD images taken by drones in mountain regions Development of expert systems for planning and coordination of search and rescue teams
Topic 6 research goals	 Developed and advances system for early detection of the visible signs of wildfire in the visible spectra Extension of the system for early detection of the visible signs of wildfire with the possibility of detecting in the near infrared spectra Developed system for assessment of accessibility of terrain based on collected aerial images Developed comprehensive intelligent system for planning and support to search and rescue teams
Research topic 7	Research in the field of electromagnetism applied to: wireless communications, electromagnetic compatibility, bio-electromagnetism, new and renewable energy sources and energy transfer
Work programme for topic 7	 Development and experimental verification of the model for quantification of EM wave absorption in an absorptive object residing in a reflective environment Development of the method for assessment of human exposure to RF EM fields inside reflective closed and semi-closed environments Development of deterministic-stochastic methods for georadar analysis and biomedical applications of electromagnetic fields Development and advancement of mathematical models for determining frequency and time response of antenna systems Analysing the effect of the room and the presence of absorption objects on the radio communication channel
Topic 7 research goals	 Developed model for quantification of EM wave absorption in an absorptive object Model applied in the analysis of the effect of the room and the presence of absorption objects on the radio communication channel Proposed new methods for assessment of human exposure to RF EM fields Developed new models for description of several types of antenna systems
Research topic 8	Health and support to human activities, i.e. biomedical engineering, development of knowledge-based systems, information and communication systems, processing of large data sets and technologies for better teaching and learning
Work programme for topic 8	 Experimental determination of the nerve response to electrical stimulation by arbitrary waveforms Development of a wideband electric field probe eliminating the error due to complex waveform Using data mining methods in software engineering Using machine learning in document processing

	 Biological (medical) signal analysis and pattern recognition Study of new communication protocols in grid systems by using discrete numerical simulations Studying of algorithms for big data transfer in distributed systems Development and application of new machine learning algorithm for classification of unbalanced datasets Development and analysis of new fast algorithms for structured matrix problems using polymorphism of Julia programming language Developed prototype for an advanced wideband electric field probe for measuring electric field
Topic 8 research goals	 Developed new systems based on datamining Proposed new, improved methods for recognising and classifying bio-signals Research of new and renewable energy sources and related information and
Research topic 9	communication technologies and systems
Work programme for topic 9	 Modelling of disordered nanostructure ensembles based on percolation theory Development of semiconductor nanostructures Measuring and modelling solar irradiance Optimisation of grid-connected photovoltaic systems with battery storage Analysis and development of energy-efficient network technologies
Topic 9 research goals	 Proposed new model for describing features of semiconductor nanostructures Application of semiconductor nanostructures to 3rd generation solar cells Application of semiconductor nanostructures in optoelectronic devices Proposed energy-efficient network technologies
Research topic 10	Smart environment
Work programme for topic 10	 Development of advanced algorithms for object detection in images Development of advanced algorithms for localization in wireless networks Development of system and advanced algorithms for human-computer interface (automatic recognition of speech, thinking patterns, gestures and emotional states) Application of ICT and intelligent technologies in environment protection Development of advanced procedures for image digital processing, analysis and understanding Functional analysis and development of bio-identification systems
Topic 10 research goals	 Developed system of augmented reality based on integration of sensor-collected data Developed system for localization in wireless networks Developed new procedures of precision virtualization Developed prototype for system using new possibilities of human-computer interface
Research topic 11	Advanced operations management and their application in the management of complex systems
Work programme for topic 11	 Development of dynamic models of manipulators with great number of degrees of freedom of movement Development of algorithm for controlling of autonomous wind-powered vessel based on analysis of sensory information Development of algorithm for localisation and control of autonomous robot Development of sensory information fusion procedures Modelling and managing complex systems Design of computer model of autonomous wind-powered vessel Design of algorithm for controlling of autonomous wind-powered vessel based on analysis of sensory information Development of algorithm for controlling of autonomous wind-powered vessel

Topic 11 research goals	 New control algorithms for autonomous robots and vehicles Developed autonomous robot cleaner Developed autonomous wind-powered vessel
Research topic 12	New technologies in industry and medicine
Work programme for topic 12	 Development of methods for measuring 3D motion kinematics based on active markers and rapid industrial cameras Analysis and development of methods for measurement of human anthropometric parameters Defining new kinematic parameters for analysis and classification of movement Development of advanced algorithms for identification of bio-signal Development of advanced algorithms for classification of bio-signal Producing signal gathering and processing units
Topic 12 research goals	 Developed prototype of a system for measuring human 3D motion kinematics Improved recognition of human movements and activities Developed advanced prototype for bio-signal classification
Research topic 13	Discovery and measurement of Higgs boson, VHE Gamma-ray astronomy
Work programme for topic 13	 Collecting and processing data for Higgs boson property measurements Development of new version of endcap electromagnetic calorimeter for the CMS detector Development of the monitoring system for the gamma-ray telescope pointing precision Analysis of VHE gamma rays emission from pulsars detected by MAGIC telescope The development and application of synthetic data generator that creates multidimensional data merging relevant 2D and 3D projections, by bottom-up procedure, with the addition of the desired number of irrelevant and redundant attributes, and the necessary level of noise
Topic 13 research goals	 Higgs boson property measurements Construct new version of endcap electromagnetic calorimeter for the CMS detector Design and construct monitoring system for the gamma-ray telescope pointing precision Based on data detected by MAGIC telescope, analyse VHE gamma rays emission Construct synthetic data generator that creates multidimensional data merging relevant 2D and 3D projections
Research topic 14	Energy efficiency in buildings, Renewable energy sources Fuel cells and hydrogen technologies
Work programme for topic 14 Topic 14 research goals	 Development of a concept for alternative solar power plant with short diffuser Analysis of energy performance of public buildings as well as households identifying possibilities for energy savings Optimisation of operational conditions and design of PEM fuel cells Water and heat management in PEM fuel cells Diagnostics of degradation of fuel cell performances Analysis of concept of hydrogen energy system and its application as power fuel of the future Thermodynamic analysis of operational processes of internal combustion engine using numerical methods Introduction of systematic energy management and fuel management in public buildings
	• Application of fuel cells for powering vehicles and autonomous systems in relation to renewable energy sources

	• Status diagnostics and optimisation of the operational process with the aim of
	increasing engine efficiency and reducing emissions
Research topic 15	Design of advanced multi-purpose vessels
Work programme for	Design of multi-purpose modular SWATH vessel.
topic 15	• Variation of submerged hull forms and selection of the best option based on
	assessment of hydrodinamic properties by analytical and numerical methods
	 Finding a solution for active hull stabilisation
	Examining 3D printer propeller model
Topic 15 research goals	Selected best option for submerged hull forms, considering the selected
	purpose of the vessel
	Propeller models completed and conducted experimental testing of fluid flow
	around the selected propulsor
	Construction of vessel prototype
	 Development of new method for active hull stabilisation of SWATH vessel, installing of corresponding system to the vessel and testing.
Deservels to via 40	Design and construction of light weight structured cores and testing
Research topic 16	Design and construction of lightweight structural components
topic 16	 Dynamic testing (stress, tension, three point bending) of static and dynamic properties of metal and polymer composite foam materials. Application of ultrasonography in lock-in thermography in detection and monitoring of cracks in polymer composites and application of micro-penetration and thermography in metal polymers (spreading of the plasticisation zone and adhesive evaluation)
	 Development of thermography as a NDT method for polymer composites with an emphasis on detecting the depth of anomaly. Development of thermography as a method for calculation of material surface deformation Research of new metal foam composites (metal shell, foam core, bonding adhesive), primarily from the point of view of mechanical properties suitable for construction of lightweight structural components, including also various aluminum alloys components in addition to samples of foam materials
Topic 16 research goals	Based on past and future resaerch in this field, expected application of calculation method and certain mechanical properties of new materials and forms in different areas of human activity: means of transport, facades in building construction, etc.
Research topic 17	Design of power transmissions with independently controllable output speed
Work programme for topic 17	Synthesis (kinematic and dynamic) of automobile transmission. Proposal of optimal transmissions (in relation to power efficiency, fuel consumption and manufacturing costs) for each type of vehicle: standard (internal combustion engine), hybrid (engine and electric propulsion system) and electric vehicles.
Topic 17 research goals	Development of series of power transmissions with output speed independent of input speed:
	without the control system and
	 with the control system for optimisation of drive speed, with higher efficiency levels of both the transmission and the system. this should lead to optimal selection of automobile transmissions for each type of drive.
Research topic 18	Linear and non-linear analysis of thin-walled structures
Work programme for	• Research of influence of shear warping and cross-section distortion on
topic 18	bending and torsion of thin-walled beams
	• Research of cross-section distortion of beam assembled of three plates subjected to torsion
	 Initiating experimental phase in the laboratory on structure models to
	confirm analytical expressions for distribution of stress in thin-walled beams
	• Planned continuation of research in the area of mathematical theory of
	plasticity of orthotropic materials, in relation to development of constitutive

	formulations for description of changes in plastic anisotropy, i.e. description
	of changes in flow function and changes in plastic potential with propagation
	of plastic deformation process
	• Planned experimental determination of changes of parameters of plastic
	anisotropy and verification of developed models for selected materials
Topic 18 research goals	Defined analytical expressions for shear warping and cross-section distortion
	on bending and torsion of thin-walled beams
	 Defined expressions for cross-section distortion of heam assembled of three
	nlates subjected to torsion in analytical form
	 Research in the area of plasticity theory will result in findings on:
	• Research in the area of plasticity theory will result in multips on.
	of plastic deformation process
	 properties of currently developed orthotropic plasticity constitutive
	formulations which enable description of changes of plastic anisotropy
Research topic 19	Development of adaptive parameterization for optimisation and meshless
	methods in dynamics
Work programme for	Adaptive and dynamic parameterization in 2D and 3D
topic 19	Parameterization based on features determined in 3D clouds
	Dynamic partitioning by features
	Parameterization with reduced number of parameters for shape optimization
	Adaptation of GA encoding for dynamic multi-partinioned models
Topic 19 research goals	Developed algorithms and software solutions
	 Testing of algorithms and solutions on real objects
Research topic 20	Modeling and optimisation of machining processes
Work programme for	• Development of alternative and advanced cooling methods in various
topic 20	machining processes
	• Development of separated particles recycling process in machining processes
Topic 20 research goals	Evaluation of efficeincy of alternative cooling methods
	• Defined mathematical model describing the dependance of output results
	such as cutting force, surface roughness and tool wear on process paramatres
	and cooling methods
	• Developed mathematical model for separated particle recycling in
	deformation process
Research topic 21	Development of innovative smart factory
Work programme for	Develop a local model of an innovative smart company
topic 21	• Equipping the laboratory with equipment of the production line for student
	training
Topic 21 research goals	Determining the optimal workstation schedule
	• Finalization of the assembly line for the production of a characteristic product
Research topic 22	Research of the influence of heat treatment parameters on the tribological
	properties of tool steel and ADI castings
Work programme for	• Determination of temperature threshold for avoidance of thermal shock on
topic 22	the surface of the die casting mold
	• Defining the temperature and the retention time at the isothermal
	temperature for the purpose of achieving desired properties of ADI castings
Topic 22 research goals	Determined temperature threshold of thermal shock
	• Determination of the intensity of damage in relation to the number of cycles
	in pressure casting
	Determined temperature and retention time for ADI castings heat treatment
L	

Research topic 23	Development of innovative methodology of numerical-experimental evaluation of energy efficiency of construction systems of passive and active building envelopes (within CEKOM projects, University of Split)
Work programme for topic 23	 Development of innovative combined methodology of numerical modelling and experimental evaluation of energy efficiency of passive and active building envelopes Design and execution of a laboratory installation for real-time testing, real construction solutions for building envelopes Numerical and experimental analysis of the energy efficiency of glass building envelopes for different construction designs of aluminium load-bearing structure Unifying the innovative methodology of a numerical-experimental test setup for actual assessment of building envelopes energy efficiency "in situ"
Topic 23 research goals	 Development of a new numerical-experimental model for assessment of energy efficiency of passive and active building envelopes in real time Patenting the methodology and possible commercial application Launch of the initiative to amend and modify relevant EU and HR standards for energy efficiency assessment of building envelopes based on simplified approach and stationary analysis models
Research topic 24	Development of the modular design concept of the hybrid module for power production by integration of photovoltaic systems and mini wind generators (within INTERREG project, FESB, Croatia, Bosnia and Herzegovina, Montenegro)
Work programme for topic 24	 Development of a hybrid solar energy and wind power generation module based on the specific bearing aluminium structure and the concept of integration of photovoltaic solar panels and mini wind turbines with a vertical rotor Design and construction of the module load-bearing aluminium structure and optimization of the functional geometry of the mini wind turbine rotor Numerical and experimental analysis and testing of the developed modular concept of the hybrid module Production and presentation of the developed module as part of the activity of the INTRREG project (HR. Bosnia and Herzegovina, Montenegro)
Topic 24 research goals	 Development of a modular aluminium structure of a hybrid solar energy and wind power generation module Protection of intellectual property rights and preparation for commercial application Promotion of structures of small solar power plants and mini wind turbines for use and installation on roofs of buildings, family houses, public institutions (schools, kindergartens etc.)