agency for science and higher education

REPORT
OF THE EXPERT PANEL
ON THE

RE-ACCREDITATION OF
FACULTY OF ELECTRICAL ENGINEERING AND COMPUTING, UNIVERSITY OF ZAGREB

Date of site visit:
April 24th – 26th 2018

MAMFORCE

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May, 2018

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INTRODUCTION

The Agency for Science and Higher Education (the Agency) is an independent legal entity with public authority, registered in the court register, and a full member of the European Quality Assurance Register for Higher Education (EQAR) and European Association for Quality Assurance in Higher Education (ENQA).

All public and private higher education institutions are subject to re-accreditation, which is conducted in five-year cycles by the Agency, in accordance with the Act on Quality Assurance in Science and Higher Education (Official Gazette 45/09) and subordinate regulations, and by following *Standards and Guidelines for Quality Assurance in the European Higher Education Area* (ESG) and good international practice in quality assurance of higher education and science.

The Agency's Accreditation Council appointed an independent Expert Panel for the evaluation of the Faculty of Electrical Engineering and Computing, University of Zagreb.

Members of the Expert Panel:

- Professor Karol Kalna, College of Engineering, Swansea University, United Kingdom of Great Britain and Northern Ireland,
- Professor Guido Maier, Politecnico di Milano, University of Milan, Republic of Italy,
- Professor Josip Balen, Faculty of Electrical Engineering, Computing and Information Technology, Josip Juraj Strossmayer University of Osijek, Republic of Croatia,
- Professor Jadranka Marasović, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split, Republic of Croatia,
- Renato Filjar, PhD, Ericsson Nikola Tesla, Zagreb, Republic of Croatia,
- Ines Džebić, student, Faculty of Electrical Engineering, Computing and Information Technology, Josip Juraj Strossmayer University of Osijek, Republic of Croatia, student.

During the site visit, the Expert Panel held meetings with the following stakeholders:

- Management,
- Self-evaluation Report Committee,
- Students,
- Heads of study programmes,
- Full-time teaching staff,
- Assistants and junior researchers,
- Heads of doctoral programmes and leaders of research projects,
- Representatives of the business sector, potential employers.

The Expert Panel members had a tour of the work facilities, laboratories, library, IT classrooms, student administration office and classrooms, and attended sample lectures, where they held a brief Q&A session with students.

In accordance with the site visit protocol, the Expert Panel examined the available additional documents and study programme descriptions (learning outcomes).

The Expert Panel drafted this Report on the re-accreditation of Faculty of Electrical Engineering and Computing, University of Zagreb on the basis of Faculty of Electrical Engineering and Computing, University of Zagreb self-evaluation report, other relevant documents and site visit.

The Report contains the following elements:

- Short description of the evaluated higher education institution,
- Brief analysis of the institutional advantages and disadvantages,
- List of institutional good practices,
- Detailed analysis of each assessment area, recommendations for improvement and quality grade for each assessment area,
- Detailed analysis of each standard, recommendations for improvement and quality grade for each standard,
- Appendices (quality assessment summary by each assessment area and standard, and site visit protocol),
- Summary.

In the analysis of the documentation, site visit to the Faculty of Electrical Engineering and Computing, University of Zagreb, and writing of the Report, the Expert Panel was supported by:

- Marina Grubišić, coordinator, ASHE
- Iva Žabarović , assistant coordinator, ASHE
- Ivana Rončević, interpreter at the site visit and translator of the Report, ASHE.

On the basis of the re-accreditation procedure conducted, and with the prior opinion of the Accreditation Council, the Agency issues a following accreditation recommendation to the Minister for Higher Education and Science:

1. **issuance of a confirmation on compliance with the requirements** for performing the activities, or parts of the activities

2. **denial of license** for performing the activities, or parts of the activities

3. **issuance of a letter of expectation** with the deadline for resolving deficiencies of up to three years. A letter of expectation can include the suspension of student enrolment within a set period.

The accreditation recommendation also includes a quality grade of a higher education institution, and recommendations for quality improvement.

SHORT DESCRIPTION OF THE EVALUATED HIGHER EDUCATION INSTITUTION

NAME OF HIGHER EDUCATION INSTITUTION:
Faculty of Electrical Engineering and Computing, University of Zagreb

ADDRESS: Unska 3, HR-10000 Zagreb

DEAN: Prof. Mislav Grgić, Ph.D.

ORGANISATIONAL STRUCTURE:

Departments:
- Department of Applied Physics
- Department of Applied Mathematics
- Department of Applied Computing
- Department of Fundamentals of Electrical Engineering and Measurements
- Department of Electric Machines, Drives and Automation
- Department of Power Systems
- Department of Telecommunications
- Department of Electronic Systems and Information Processing
- Department of Control and Computer Engineering
- Department of Electroacoustics
- Department of Electronics, Microelectronics, Computer and Intelligent Systems
- Department of Wireless Communications
    - Secretary's office
    - Finance Department
    - Central Library
    - Information Support Centre
    - Research Support Centre
    - Career Centre

STUDY PROGRAMMES:

Undergraduate studies;

- Electrical Engineering and Information Technology
- Computing

Graduate Studies;

- Computing
- Information and Communication Technology
- Electrical Engineering and Information Technology

Specialist studies:

- Transformers
- Information Security
- Railway Electrotechnical Systems
- Regulation of the Electronic Communications Market
- Intellectual property

Doctoral study;

- Electrical Engineering and Computing

NUMBER OF STUDENTS: 3.576

NUMBER OF TEACHERS: 189

SHORT DESCRIPTION OF THE EVALUATED HIGHER EDUCATION INSTITUTION

The Electrical Engineering studies in Croatia begun on 10 December, 1918 with the foundation of the Technical College in Zagreb. On 31 August 1926, the Technical College was transformed to the Technical Faculty and was joined with the University of Zagreb.
After a decision of the Parliament of the Peoples Republic of Croatia, on 26 April 1956, the Faculty of Electrical Engineering was founded, by transformation of sections of the Technical Faculty in Zagreb in the separate faculties. As a part of the ETF-1 curriculum, lectures were given in two courses, the High and Low Current programs.
In 1995, by recognizing the importance of computer science discipline, the Faculty changed its name to Faculty of Electrical Engineering and Computing. Also, the new FER-1 curriculum was adopted, which for the first time had two major study programs: Electrical Engineering with 6 study programs, which mainly correspond to the old curriculum, and Computing Engineering.
With the 2005 reform, the so-called Bologna process, FER saw as an opportunity for a new modernization of the study programs, and also for substantial modifications of the curriculum. As a part of the current FER-2 curriculum, on the undergraduate level, there are two major study programs, Electrical Engineering and Information Technology, and Computing. In 2006, the Faculty went through a process of international accreditation and received accreditation from the German accreditation agency ASIIN (*Akkreditierungsagentur für Studiengänge der Ingenieurwissenschaften, der Informatik, der Naturwissenschaften und der Mathematik*) for its study programs and the ability to award academic titles Bachelor of Science and Master of Science. With the introduction of the State Matura in 2009, FER was among the first to accept the new system of enrolment into the institutions of high education, realising that this broadened the circle of candidates and gave it the opportunity to choose even better students for the enrolment into the first year of study. FER had started with doctoral studies before the Bologna reform, at the time when doctoral dissertations on other faculties were made outside the doctoral studies. Until the academic year 2008/2009, doctoral studies included a higher content of lectures. From the academic year 2009/2010, the new program has been adopted, with a lower number of lectures and an increased amount of research, with research seminars and seminars for the acquisition of generic skills.
At the end of 2011, the work on the new study programme FER3 started. Undergraduate study programme was accredited at the end of 2017 and will start in 2018. In 2013, our study programmes were reaccredited until 2018 by the German accreditation agency ASIIN.

BRIEF ANALYSIS OF THE INSTITUTIONAL ADVANTAGES AND DISADVANTAGES

ADVANTAGES OF THE INSTITUTION

1. Clearly defined rules.
2. Organisational structure of the teaching process.
3. Management and updating of learning outcomes and excellent support of students during the whole study including employment.
4. An efficient and well-established information system developed and operated by FER staff.
5. Scientific record as the result of systematic encouragement and support to academics and students.

DISADVANTAGES OF THE INSTITUTION

1. Improvement in internship system is needed.
2. Improvement to internal structure to allow for a more efficient research process as the parallel structure of traditional departments and research laboratories causes obstacles and inefficiencies in both research and teaching,
3. Improvement to teaching workload assignment to favour research activity of young staff.
4. Improvement to outgoing mobility of students.
5. Laboratories with outdated equipment should be detected and prioritised, and equipment should be modernised.

EXAMPLES OF GOOD PRACTICE

1. The Faculty has a permanent laboratory staff dedicated to full maintenance of lab equipment: this ensures a long duration of lab instruments and contributes to making the teaching laboratories always available for a large number of experimental courses.
2. Management and updating of learning outcomes.
3. Transfer of scientific knowledge acquired during research into teaching process.
4. Dialogue among and discussion within academic staff.
5. Forward thinking towards future needs of the institution.

ANALYSIS OF EACH ASSESSMENT AREA, RECOMMENDATIONS FOR IMPROVEMENT AND QUALITY GRADE FOR EACH ASSESSMENT AREA

I. *Internal quality assurance and the social role of the higher education institution*

Analysis

The Faculty has established a functional internal quality assurance system and has partly responded to the recommendations formulated in the previous external evaluations. The Faculty supports academic integrity and freedom developing the system for preventing all types of unethical behaviour, intolerance and discrimination. The Faculty ensures the availability of information on important aspects of its activity and understands and encourages continuous development of its social role.

Recommendations for improvement

It is strongly recommended that more effort be made to monitor dynamic changes in the quality assurance system by introducing new content into appropriate documents, to continue to develop a system and respective tools (software, etc.) to prevent all forms of unethical behaviour, especially plagiarism.

Quality grade: **Satisfactory level of quality**

II. *Study programmes*

Analysis

After analysing all the detailed standards related to study programmes, this panel agrees on the general conclusion that FER offers an excellent study programme which is implemented in an effective and organized way. The learning outcomes FER students achieve are compliant with the requirements of the labour market and the needs of Croatian society, making FER graduates well-suited competitors on the labour market.

FER is also able to constantly adjust, update and improve its programmes. Evidence of that is the next-to-come adoption of a new programme FER-3 which will pursue, among other objectives, the important task of opening FER to significant flows of selected foreign students, by adopting English as the main teaching language for the majority of courses, both at the undergraduate and the graduate level.

Recommendations for improvement

Besides other minor recommendations, the panel envisions good chances of improvement in the internship programmes, in order to improve integration of student practice into FER study programmes.

On the other hand, the panel's concern is that FER would not be able to find required resources for complete implementation of the novel and advanced but challenging FER-

3 programme in a situation when the workload of FER teachers is already high and when it is difficult for them to balance teaching with their research activity. Therefore, the panel recommends FER management to focus efforts on clearly explaining the advantages and the importance of FER-3 programme to university staff, academic representatives and national authorities in order to obtain sufficient support to sustain this transition.

Quality grade: **High level of quality**

III. *Teaching process and student support*

Analysis

Teaching process at FER is well defined and organized on a high level of quality on all study programmes. Admission criteria are clearly defined and transparent, which enables the selection of the best candidates that are capable of successfully finishing the studies. Various teaching methods and state-of-the-art technologies are used in order to improve an overall teaching process. FER analyses students' progress and satisfaction through various surveys. Based on those results, several mechanisms were applied resulting in higher pass rates and a better study completion. Evaluation and assessment of student achievements at FER is consistent and conducted in accordance with predetermined procedures and methods applied equally to all students. FER has established several offices and services that provide a high quality and a diverse support to all groups of students during the whole study cycle and afterwards through Career Center. During the education, FER graduates gain competencies required by labour market which results in an extremely high employment rate.

Recommendations for improvement

Although an overall teaching process and students support provided by FER is exemplary, there are several areas that can be further improved. Since the incoming student mobility is growing and currently is higher than the outgoing mobility, it is obvious that FER attracts foreign students and, therefore, a new FER-3 study programme should take into account this trend and even improve it. It is recommended to improve a strategy for encouraging further domestic students to use opportunities for the outgoing mobility in order to gain an international experience. Furthermore, there are good chances of improvement in teaching staff education and renovation of outdated laboratory equipment.

Quality grade: **High level of quality**

IV. *Teaching and institutional capacities*

Analysis

The Faculty commands all necessary resources needed to deliver a high quality education and a world-leading level of research. The institution employs a sufficient number of academic staff including teachers and researchers to offer top quality education for domestic and international students in electrical engineering and computing in Croatia. The professional development of the academic staff and technical staff is well supported by a dedicated service offering high quality and timeless courses and training. The growth of academic and support staff is sensibly managed by well defined, publicly-open, and rule-obeying employment process. The teaching and research process is very well supported by adequate facilities, services, and consumables.

Recommendations for improvement

Our recommendation include i) improvement of the system of teaching load assignment, ii) consideration of an online job application system, and iii) setting up a web-page listing all the opportunities for professional development for academic staff.

Quality grade: **High level of quality**

V. *Scientific/artistic activity*

Analysis

The Croatian Agency for Science and Higher Education (AZVO) awarded the high quality label to the doctoral programme of Electrical Engineering and Computing based on the re-accreditation procedure. FER is committed to achieving high quality and large quantity of scientific research conducted by teachers, senior and junior researchers, and students in internal, national and international projects. The institution makes good efforts to align and transfer knowledge between scientific and teaching/educational areas.

Recommendations for improvement

FER is recommended by the panel to: i) consider internal restructuring to allow for the optimisation of resources, scientific production and knowledge transfer from science to education, as well as for sustainable development of its internal units in response for fast-pacing technology development; ii) maintain a transparent and consolidated record of its employees scientific accomplishments, contribution to scientific and professional journals and conferences, membership in editorial boards and conference committees, and awards, based on self-maintained records in the Faculty's information system.

Quality grade: **High level of quality**

DETAILED ANALYSIS OF EACH STANDARD, RECOMMENDATIONS FOR IMPROVEMENT AND QUALITY GRADE FOR EACH STANDARD

I. Internal quality assurance and the social role of the higher education institution

1.1. The higher education institution has established a functional internal quality assurance system.

Analysis

Internal quality assurance system is functional and includes and evaluates all the activities that are carried out at the Faculty. According to the Regulations of the Faculty quality assurance system, the bodies responsible for the quality management system are the Faculty Council and the Quality Management Committee. In some areas of the quality assurance, other bodies of the Faculty participate within the scope of their competence. The Committee is an advisory and expert body of the Faculty Council and the Dean. The Committee consists of at least seven members, at least six members are elected among the staff members in scientific-teaching professions, and one member of the Committee is proposed from the Faculty students organization. Self-evaluation evidence, provided by the Faculty, confirm that the additional members of the Quality Management Committee include: the representatives of employers, administrative staff, technical staff, and assistants.

For the purposes of writing the self-evaluation report a wider working group was formed, consisting of representatives of the Faculty and the bodies of the Faculty Council, but no representatives of students were included in the working group.

Self-evaluation evidence includes faculty-level documents but they do not conform with the new ESG standards and there is no evidence that they are adapted to the corresponding University documents. The evidence shows that the Quality Policy was adopted in July 2012, the Quality Assurance Manual in June 2013, the Regulations on Quality Assurance in March 2011 and the Faculty Development Strategy was developed for the period 2013–2017 (valid until June 2018). Evidence (self-evaluation report and visit) includes the documents from internal evaluations of the quality assurance system, established action plans and the reports on their implementation.

Recommendations for improvement

It is recommended to increase the visibility of quality assurance measures. The measures and analysis based on the results of different surveys should be also better presented, in order to make their feedback evident. More effort should be made to

monitor dynamic changes in the quality assurance system by introducing new content into appropriate documents. Students need to be involved in all bodies responsible for the quality management system, as well as in the working groups for the preparation of the future self-evaluation reports. It is necessary to define a new Faculty Development Strategy, as the current one is valid up to June 2018. It is suggested to analyse and to verify data entered into MOZVAG system, because unclear information was found in the enclosed tables.
Quality grade: **Satisfactory level of quality**

1.2. The higher education institution implements recommendations for quality improvement from previous evaluations.

Analysis
The Faculty has partly applied the suggestions for improvements and is carrying out activities based on the external evaluation of the quality assurance system (2012) and the internal evaluation of the quality assurance system (2013, 2015 and 2017). Reaccreditation was carried out in 2012. International re-accreditation of study programmes was carried out by the re-accreditation agency ASIIN in 2013. The Faculty is analysing improvements and planning further development on that basis.
Committee for quality management continually organises, coordinates and implements quality assessment methods, and develops internal quality control mechanisms. The Committee publishes reports and other documents related to quality control (quality policy, assessments, guest presentations at the board meetings, educational activities information for teachers, etc.) on its web page.
FER offers one doctoral study programme entitled "Electrical Engineering and Computing". In the past five years, this programme has been subject to two evaluations:
- periodic internal evaluation performed by the University of Zagreb, according to the Regulations of the procedure of evaluation of doctoral study programmes, which was successfully completed in June 2014.
- reaccreditation process for postgraduate (doctoral) university study programmes, performed by the Agency for Science and Higher Education (AZVO) following the recommendation of the Ministry of Science and Education of the Republic of Croatia (from January to September 2016). In April 2017, FER received the final Confirmation of the Ministry of Science and Education of the Republic of Croatia which certifies that FER "... fulfils the requirements for executing the part of its activities related to the implementation of the postgraduate (doctoral) programme Electrical Engineering and Computing (...)". Examples of implementing the recommendations from the previous evaluations of the doctoral study programme (specifically, the periodic internal evaluation by the University of Zagreb, completed in 2014) include: achieving a full alignment with the "umbrella" regulations for doctoral studies at the University of

Zagreb, regular annual reporting on the progress of doctoral students (by both students and mentors), required attendance of mentoring workshops for first-time mentors (only partially successful, considering that the University of Zagreb first discontinued workshops, and then discontinued this requirement as such), required research proposal approval by the prospective mentor when applying for admission to the doctoral programme, required proof of research activity for teachers in the doctoral programme when preparing the teaching plan for the next academic year. Self-evaluation report provides evidence about the creation of action plans and the reports of their implementation.

Recommendations for improvement
Self-evaluation report evidence has provided that the Faculty partially applied suggestions for improvements from the previous external evaluations of the quality assurance system (2012). It is recommended to apply following suggestions:
- FER is a large faculty with a multilevel structure. The structure is very complex and its efficiency is questionable. It is recommended to think about the organisational structure reconstruction.
Quality grade: **Satisfactory level of quality**

1.3. The higher education institution supports academic integrity and freedom, prevents all types of unethical behaviour, intolerance and discrimination.

Analysis
At the Faculty, great attention is dedicated toward respecting academic integrity and freedom and to preventing all forms of unethical behaviour, intolerance and discrimination. Basic ethical principles and values are prescribed by the Code of Ethics of the University of Zagreb. Implementation of those values at the Faculty is supported by two committees: the Ethics Committee and the Disciplinary Committee for Students. These committees are appointed by the Faculty Council at the dean's proposal. The Ethics Committee has five members (three teachers and two students).
The Ethics Committee monitors the implementation of the Code of Ethics at the Faculty and deals with violation issues. Every employee or student of the Faculty may contact the Ethics Committee to indicate an infringement of the Code of Ethics. There have been no reports of violations of the Code of Ethics in the past five years. The Ethics Committee is charged with respecting ethical norms in scientific research and checking for possible conflict of interest when submitting science research projects and topics of doctoral dissertations. Disciplinary committee for students has three members, two teachers and one student. The Faculty Council adopted the Ordinance on disciplinary responsibility of students on 29 June 2011, regulating disciplinary responsibilities of students.

Recommendations for improvement
In general, the current settings largely assure implementation of academic integrity and freedom and prevent all types of unethical behaviour, intolerance and discrimination. It is recommended to continue with the developed rules and promote and encourage the same spirit among all stakeholders of the Faculty. Furthermore, there is no evidence about plagiarism prevention and detection procedures and tools (software, etc.). It should be developed and used systematically for final theses, diploma theses and in scientific research.
Quality grade: **Satisfactory level of quality**

1.4. The higher education institution ensures the availability of information on important aspects of its activities (teaching, scientific/artistic and social).

Analysis
Important information about FER is available on FER's website and also through sub-websites dedicated to individual projects, research laboratories, programmes, events, etc. The results of research and technology transfer are also available at FER's Student Incubator for Entrepreneurship – SPOCK.
FER reports about its events and the successful projects, research, students and employees through social networks.
The programme of popularization of science, technology, engineering and mathematics "ŠUZA" - from the School of Science to the Academic Community" was started by the Faculty of Electrical Engineering and Computing in 2012. The mission of the programme is to motivate students for the STEM fields and to educate STEM teachers and educators across the entire educational vertical. The programme is implemented with the support of the Education and Teacher Training Agency and the Agency for Vocational Education and Training and Adult Education.
A number of workshops for teachers (elementary and high school), university students and faculty members, popular-scientific lectures and competitions were held too. The Faculty members participate in science festivals, exhibitions of innovations and fairs, the World Days of STEM area and workshops at the Faculty or guest workshops in schools and libraries.
Every year, FER Open Day is organised, where the Faculty staff demonstrate results and experiments from the scientific areas in which they do their research.

Recommendations for improvement
None
Quality grade: **High level of quality**

1.5. The higher education institution understands and encourages the development of its social role.

Analysis

One of the basic tasks of FER is to make a significant contribution to the economy through teaching and research in the field of electrical engineering, computing and information-communication technology (along with the natural-sciences background provided by applied mathematics and applied physics), and to develop the economy and the public sector by innovations with the purpose of overall social development, as stated in the Mission of the Faculty.

FER has set up a Career Centre which, through direct student entrepreneurship directly allows student innovation ideas to penetrate the market through newly developed start-ups. Job Fair, the largest fair of jobs in Croatia, held at FER, systematically and directly introduces students to opportunities for employment and career development in Croatia and abroad, and connects employers to the best students of the University of Zagreb. Direct contribution to the development of the economy is ensured through implemented research projects funded through the Horizon 2020 programmes and the programmes of the European Structural and Investment Funds. FER has a significant civil role through its contribution to the development of civil society, which is evident from a large number of student and professional associations that FER supports, and which are founded, or operate at the Faculty.

Recommendations for improvement

The Faculty contributes significantly towards society. While we encourage maintaining the current activities, we recommend enhancing a social role of ALUMNI society to improve society performance and quality.

Quality grade: **High level of quality**

II. Study programmes

2.1. The general objectives of all study programmes are in line with the mission and strategic goals of the higher education institution and the needs of the society.

Analysis
FER general goals of all its study programmes are in line with FER mission and strategic goals. The analysis of the market conducted by FER and by the Institute of Economics upon mandate of the Croatian Ministry of Science and Education show a rapidly expanding labour market, with an increasing need for engineers in the ICT sector. This situation is forecast to remain unchanged for the next 2-3 years. So, FER programmes are perfectly justified in the framework of country development.
Given this fact, FER chooses as strategy not to lower the quality of teaching in order to increase the number of students (e.g. preserving the maximum number of students per classroom under 80 for the majority of courses and the ratio between teachers and students below 1/10). Therefore, the quotas of freshmen for the programmes are dimensioned according to the teaching capacity of the institution. This Panel agrees with this strategy, as it allows FER to produce extremely competitive professionals for the national and international labour market.
It is however well agreed upon that, in case sufficient resources will be available, FER should expand its student population to take all opportunities offered by the labour market. This can be accomplished by increasing the flow of highly qualified foreign students who will attend the full undergraduate and graduate programmes at FER, which also implies offering (most of the) courses in English. FER is well aware of this solution, which has been enclosed as a major objective in the new FER-3 study programme.

Recommendations for improvement
None
Quality grade: **High level of quality**

2.2. The intended learning outcomes at the level of study programmes delivered by the higher education institution are aligned with the level and profile of qualifications gained.

Analysis
FER's Learning Outcomes (LO) at programme level are clearly defined and were selected following the indications of outstanding international accreditation agencies (namely, ASIIN from Germany and ARET from USA).

All LO of all study programmes appear aligned with the CroQF and EQF level descriptors. They clearly reflect the competence required for employment and continuing education.
FER has created an extremely effective system to align the LO at the course level with the LO at the programme level. This system is based on a web portal where each professor periodically maps the LO at course with the LO at programme level. The system provides data in the form of dynamic tables that are constantly monitored by the vice-dean for teaching and various other committees, to verify alignment and even distribution of the student workload on the different LOs.
Course-level LO are clearly reported in the course catalogues and in each exam, so students are always informed about the LOs they have achieved and they still have to achieve. Achieved programme level LOs are also clearly reported on the diploma supplement.

Recommendations for improvement
None
Quality grade: **High level of quality**

2.3. The higher education institution provides evidence of the achievement of intended learning outcomes of the study programmes it delivers.

Analysis
FER ensures the achievement of the intended LOs, as confirmed by the feedback obtained from students, graduates, employers and stakeholders. It is further confirmed by the high demand for FER graduates in the labour market.
Written exams, project tasks and theses always appear to be tuned to the proposed LOs. (This Panel did not have the possibility of assisting to any oral exam).
There is no explicit final examination to assess the achievement of the LOs, as FER assumes the successful completion of all exams and of the thesis work to be an implicit proof of achievement: this practice is perfectly acceptable and agreeable.
FER continually revises and improves the teaching process on the basis of achievements of the LOs. The main methods to accomplish that are: the web portal mentioned above allowing for a dynamic mapping of the programme vs. course LOs; the anonymous surveys by which students of each course evaluate the teaching activity of the course; a mutual peer-reviewing system performed by professors, who monitor each-other course and report to teaching committees. This last method does not result from the documentation provided, but it was reported by the vice-dean for teaching in an interview.

Recommendations for improvement
The documentation provided by FER to this Panel included some master and undergraduate theses. Based on the examination of those theses, the Panel recommends FER to ensure that master and undergraduate theses follow international standards of referencing and citations.
Quality grade: **High level of quality**

2.4. The HEI uses feedback from students, employers, professional organisations and alumni in the procedures of planning, proposing and approving new programmes, and revising or closing the existing programmes.

Analysis
FER study programmes will undergo a thorough innovation with the gradual introduction of the so-called FER-3 study programme, starting from the first semester of the first year of undergraduate programme in 2019 and then gradually deploying the new programme in the subsequent years.
FER-3 appears the result of a long and continuous process of improvement carried out in the last years on the previous FER-2, also on the basis of multiple re-accreditation and external-review procedures. FER-3 documents are not yet final and entirely available to the public. However, the several interviews this Panel had with dean and vice-deans, administration, students and stakeholders, clearly show that: in the elaboration of FER-3 all recommendations and outcomes of previous re-accreditation and reviewing procedures have been taken into account; students have actively participated in the elaboration of FER-3 and the discussions on the final documents within the Faculty council; drafts of FER-3 have been submitted to the external stakeholders (especially industrial partners) who had the opportunity of proposing changes and observations, later included in the revised documents.
The interactive and iterative process of FER-3 elaboration concluded with the recent approval by the Faculty council and its submission to University for final approval.

Recommendations for improvement
None
Quality grade: **High level of quality**

2.5. The higher education institution ensures that ECTS allocation is adequate.

Analysis
The same tools used by FER to manage the LOs are also exploited to manage the assignment of ECTS to courses and to estimate the student workload for each course.

Furthermore, the system verifies a fair distribution of workload among the programme-level LO.
Besides this *a priori* action, FER dedicates effort to check the consistency of assigned ECTS with the effective student workload *a posteriori*. This is carried out by analysing the teacher surveys students have to fill in towards the end of each semester.
Moreover, FER has carried out specific projects, such as *Kalorimetar*, reported in the self-assessment document, to determine the actual student workload by specific questionnaires submitted by selected group of students. This initiative pointed out a general good alignment of ECTS to actual workload, with few exceptions that have been subsequently normalized.

Recommendations for improvement
None
Quality grade: **High level of quality**

2.6. Student practice is an integral part of study programmes (where applicable).

Analysis
The integration of student practice into the study programmes is indeed promoted and favoured by FER. The main instrument devised by FER in order to pursue this goal is an internship programme (including FER Summer Internship Programme and FER Internship Programme) FER organizes with the cooperation of several national and international industrial partners. This programme is used to allow students experiencing brief working periods in real production realities, in order to make them more aware of the expertise it is expected from them once entering the labour market and to let companies have an early meeting with potential future candidates to the recruitment head-hunting phase.
Besides this main instrument, FER organizes events such as the Job fairs and Carrier speed-dates to foster encounter of students with companies. It is also worth to mention that FER students (especially in the graduate and Phd programmes) have several opportunities for experiencing cooperative work with industry in the numerous research projects and contracts FER has with industrial partners.
By interviewing students, this Panel detected that several potential users of the FER internship programme prefer instead to pursue the alternative of finding internship positions by directly contacting the companies. The reason of this preference, stated multiple times by students, is that internships offered by FER's programme are often less economically compensated than internships directly and personally contracted with companies. FER management confirmed that such differences exist, since their policy is not to impose any minimum internship compensation level to companies participating in the programme. This policy guarantees that some large and important companies do

not leave the programme, considering that economic compensation is not the only and main advantage for students participating in internships. This Panel does not object to this policy, which can be regarded as good practice.

Recommendations for improvement
FER is recommended to **improve the service offered to students by its internship programmes, which are currently not very efficient**. According to this Panel, there is room for improvement even without imposing any constraint to companies with regards to a minimum economic compensation of internships. For example, FER internship programmes could improve the communication towards students by strengthening the message that economic compensation is not necessarily the main parameter to consider when selecting an internship. FER could emphasize other parameters for each company offering internships, such as the number of open permanent positions, level of salary for permanent jobs, ratio of internships that successfully led to permanent employment in the same company in past editions, etc. The possibility of comparing multiple factors would ultimately make internship services offered by FER more appealing for students.
Quality grade: **Satisfactory level of quality**

2.7. Lifelong learning programmes delivered by the higher education institution are aligned with the strategic goals and the mission of the higher education institution, and social needs.

Analysis
FER supports lifelong learning by offering a set of Specialist studies, covering interesting and updated technological, techno-economical and legal topics or more specific topics of interest for public institutions or large companies.
Currently, there are 4 studies on catalogue, but their actual implementation depends on the number of attendees (for instance, only 3 of these courses are active this year, as explained to the Panel by the dean-elected in an interview).
Funding for this specialist studies is mainly raised from the fees of the paying participants.
One of these studies, focusing on intellectual property, has been requested and directly promoted by the Croatian Ministry of Science Education and Sport.
Further details regarding approval and regulatory framework for these specialist courses are clearly reported in the Self-evaluation report provided by FER.
It is the Panel's opinion that FER Specialist studies represent an appropriate implementation of lifelong learning programme and guarantee a high level of quality.

Recommendations for improvement - none
Quality grade: **High level of quality**

III. Teaching process and student support

3.1. Admission criteria or criteria for the continuation of studies are in line with the requirements of the study programme, clearly defined, published and consistently applied.

Analysis
Admission criteria for all available study programmes (undergraduate, graduate, and postgraduate) is clear, well defined, published on the official Faculty Internet page and consistently applied. An example of a good practice is having the FAQ (Frequently Asked Questions) section where students can find answers to the most common questions and doubts regarding admission criteria and enrolment conditions. Enrolment to undergraduate studies is based on the student's success during the high school and the achieved results on the State Matura. The whole process is transparent and it is conducted through the National Information Application System. In order to ensure the selection of the best candidates that are capable to successfully finish graduate studies, FER adopts the admission criteria by including a preliminary exam for students who studied undergraduate studies longer than four years or are coming from international studies without accreditation. Furthermore, students coming from other HEIs are obliged to enrol in additional differential courses (usually below four courses in total). The number of students coming from another HEI having additional differential courses is relatively small (<4% of all students on the graduate studies) but those students are required to put more effort compared to other students to successfully finish the first year of graduate studies. Continuation of a study in case of deferred or interrupted study is also possible but the interest in this activity is extremely low. Since it highly depends on the individual case, there are no generally defined criteria but rather every individual case is processed separately.

Recommendations for improvement
We recommend considering lowering student workload for students from other HEIs enrolled in graduate studies.
Quality grade: **High level of quality**

3.2. The higher education institution gathers and analyses information on student progress and uses it to ensure the continuity and completion of study.

Analysis
FER gathers and analyses information on student progress using their own software continuously, starting from State Matura until their graduation. Collected information shows that most successful high school students in Croatia enrol at FER. They are also

analysing student performance and pass rates in general and for individual study courses, study programme status and vertical mobility between undergraduate and graduate level. According to the results of all collected data, FER is initiating necessary action if needed. There are three examples of good practice for taking action based on analysed information.
The first example is that FER recognized the need for student pass rate improvement for elementary courses. Each year, voluntary ranking exam for freshmen is organized, and students are advised based on the results of that exam. As a measure, three weeks of online courses and one week of exercises is organised for students with lower exam pass rating. As a result of this measure, the pass rate for those courses has been significantly improved. Secondly, in order to determine whether the nominal workload expressed in ECTS credits matches with the actual student workload in individual courses, FER conducted the "*Projekt Kalorimetar*". This example contributed to the adjustment of workload for the existing study programmes, as well as for the future FER3 programme. Third example of a good practice is that FER takes first year student pass rates and uses is partly as a measurement for enrolling quotas and partly to maintain the quality of study programmes.

Recommendations for improvement
None
Quality grade: **High level of quality**

3.3. The higher education institution ensures student-centred learning.

Analysis
Besides lectures, auditory and laboratory exercises, students at FER are having individual and group projects and seminars. Some of the teachers gave us examples of taking their students to field work in order to get better understanding of problems and to improve their creative and critical thinking. Considering that FER has enviable scientific research programme, students have the opportunity to also take part in scientific research. FER encourages autonomy and responsibility in students, especially at the graduate level where around one third of whole teaching is being conducted as mentor-guided courses.
Students are evaluating teachers and teaching methods through surveys. We were provided with examples of how teachers have changed and adapted their teaching methods based on results they got from those surveys. Also, survey results on courses have significantly helped in implementing the new FER-3 programme, where students will have even more laboratory, project based and problem solving work.
FER uses state-of-the-art technologies to modernise the overall teaching process. Great example is the modern scheduling software, developed and used on FER, which helps

both students and teachers in more efficient time and resource management. Furthermore, teaching materials are being constantly refreshed and updated on e-learning system which is used for all courses. However, students were concerned with the fact that some of the literature for some courses might be outdated, as well as some laboratory equipment. We agree that a small quantity of laboratory equipment is outdated, but still useful. Meanwhile, FER has some of the most modern and expensive laboratory equipment in the region.

Recommendations for improvement
It is recommended, that in further Faculty's actions and strategy plans, laboratories with outdated equipment should be detected and prioritised, and equipment should be replaced or refreshed.
Quality grade: **High level of quality**

3.4. The higher education institution ensures adequate student support.

Analysis
FER pays special attention to providing their students with high quality and diverse support. FER has established Student Administration Office, Student Counselling Service, Student Council, Career Centre, Coordinator for people for students with disabilities, Mobility Office with ECTS coordinators for international students. Based on student feedback, it is obvious that they also have good support from the Faculty management, as well as from the teaching staff. FER has established an efficient student support and mentoring system. There are many counsellors appointed by the Faculty Council, and organised and supervised by Vice Dean for teaching, who are in charge of helping first-year students. Furthermore, during the fourth semester of undergraduate study programme, a mentor professor is assigned to each student. The cooperation between mentor and student is usually fruitful, and therefore continues until the end of student education.
In addition to the formal support system, FER students have KSET (*Klub Studenata Elektrotehnike*), sports and arts companionships and many other informal support groups.

Recommendations for improvement
None
Quality grade: **High level of quality**

3.5. The higher education institution ensures support to students from vulnerable and under-represented groups.

Analysis
FER has established support service for students from vulnerable and under-represented groups. As stated in Self-evaluation report, FER is providing support in different manners: space accessibility, access to information, data privacy, individual assistants and customization of teaching and knowledge assessment (e.g. adaptation of teaching and examination materials, prolonged examination time, etc.).
Since female students in technical fields are considered as an under-represented group, we have to point out that FER encourages young girls and women to start their studies at FER. Some good examples are organization or support of projects like "#*FERgirl*" and "*Girls in ICT*".

Recommendations for improvement
None
Quality grade: **High level of quality**

3.6. The higher education institution allows students to gain international experience.

Analysis
In general, FER allows students to gain international experience through several different programmes. Besides a few research based trips to foreign countries, several international internships, the majority of students is using Erasmus+ student exchange programme. Mobility Office established at the Faculty provides students with information and helps them in all phases of mobility. Seven ECTS coordinators helps students in even more detailed manner and Student Administration office deals with the recognition of passed courses and acquired ECTS credits. We were concerned with students' feedback that issues usually appear regarding ECTS recognition and regular continuation of their study if they use outgoing exchange opportunities, although based on the evidence that was found, the minority of students experienced similar issues.
However, we were concerned with the total number of students who are taking this opportunity to study abroad or to gain international experience in some other way.

Recommendations for improvement
It is recommended that FER improves the strategy for encouraging students to such ventures in order to increase the number of students who are gaining international experience.
Quality grade: **Satisfactory level of quality**

3.7. The higher education institution ensures adequate study conditions for foreign students.

Analysis
Foreign students at FER can be enrolled through an exchange programme (one or two semesters) or as foreign students with full student rights enrolled in full study cycle (on average 6-10 students per year). Student mobility to FER is possible through several international student exchange programmes such as Erasmus, Erasmus+, Erasmus Mundus, CEEPUS and bilateral agreements that the University of Zagreb or the Faculty have achieved with foreign universities. In coordination with Student Administration Office and Mobility Office, ECTS Coordinator provides administrative support and takes care of Learning Agreements for incoming students. FER offers considerable number of various courses in the English language (level L1-L3, explained in ECTS Information Package - Undergraduate Study and ECTS Information Package - Graduate Study). The Faculty's official website and all important documents also have an English version. Even though the number of incoming students is enviable, with FER3 programme, the Faculty's plan is to upgrade study programmes in a way of performing all the courses in English.

Recommendations for improvement
We recommend that FER continues on planning and improving FER-3 study programme in a direction of increasing the number of foreign students considering our analysis above as well as anticipating a drop in the number of high school graduates in the next 5 years, in order to increase the quality and recognisability at the international level.
Quality grade: **High level of quality**

3.8. The higher education institution ensures an objective and consistent evaluation and assessment of student achievements.

Analysis
Evaluation of student achievements at FER is consistent and conducted in accordance with predetermined procedures and methods applied equally to all students. Criteria of evaluation for all courses on all study levels is published for every academic year in advance in the ECTS Information Package - Course catalogue adopted by the Faculty Council and also on the first lecture of every course. A formal procedure for dealing with complaints and appeals made by students is clearly defined and quickly conducted. According to student feedback teachers are objective and efficient in resolving possible issues regarding exam assessment, and students are provided with relevant feedback.

Furthermore, teachers update their exams and evaluation procedure based on the conducted meta evaluation and feedback on the effectiveness of exams gathered from students. A good example of implementing a procedure for ensuring the objectivity and reliability of grading is on exams with a huge number of students where every teacher corrects the same question in every exam, which ensures the same conditions and criteria for all students. The choice of procedures and evaluation method takes into account particular circumstances or cases such as modifications of exams and assessment procedures for students from vulnerable and underrepresented groups. Modifications usually include extension of examination time and bigger fonts on exams and it is conducted according to a predefined procedure. Development of teacher skills in the area of teaching and assessment is supported by FER by organizing various workshops and lectures. However, a low number of teaching staff is attending those events.

Recommendations for improvement
We recommend that FER should motivate their teaching staff to attend more workshops and lectures where they can improve their teaching and assessment skills.
Quality grade: **High level of quality**

3.9. The higher education institution guarantees the issuance of Diploma Supplements and adequate qualification information.

Analysis
Higher education institutions in Croatia are required to issue Diplomas and Diploma Supplements, in Croatian and English, to each student who completes Bologna study programmes. Each student of FER, after finishing the studies, is presented with Diploma and Diploma Supplement. The Diploma Supplement contains additional information about the study, the qualification obtained and the level of qualification acquired (degree of qualification, duration of study, level of degree needed to access the study), information about the grading system, employment opportunities, inclusion in further study programmes, information about the higher education system in the Republic of Croatia, and an overview of the courses a student passed during the study with achieved ECTS credits, grades and acquired competences.

Recommendations for improvement
None
Quality grade: **High level of quality**

3.10. The higher education institution is responsible for the employability of graduates.

Analysis

FER is very successful in delivering highly educated graduates to labour market. The vast majority finds employment fast and easily and starts building their career immediately after the graduation or even during their studies. It should also be mentioned that student internships often result as a job offer or permanent employment.

FER has established a Career Centre which plays an important role in students employment and organises various events like Job fair and Career Speed Dating, which make students aware of job opportunities through hand to hand experience with employers and representatives of the most successful domestic and foreign companies. Furthermore, the Faculty and Career Centre are organizing numerous lectures and workshops for skills improvement. For the past two years, FER has been also encouraging student entrepreneurship through SPOCK programme, which supports students in the development of their innovating ideas and in running their own start-up companies.

Based on the feedback from alumni, it is obvious that FER is open for any type of collaboration and keeps a strong bond with former students.

Recommendations for improvement

None

Quality grade: **High level of quality**

IV. Teaching and institutional capacities

4.1. The higher education institution ensures adequate teaching capacities.

Analysis
The FER reports academic staff consisting of 84 full professors, 45 associate professors, and 60 assistant professors. Additionally, the Faculty has 19 postgraduate students, 41 teaching instructors, 4 professional associates, 35 teaching instructors funded by the Croatian Science Foundation, 32 self-funded teaching instructors and postgraduate students. Finally, the Faculty uses more than 50 external associates to help with the two undergraduate study programmes and three graduate programmes. At the moment, the Faculty has 3216 students at undergraduate and graduate study programmes together.
The Faculty plans, when transforming from FER2 to FER3 programme, to reduce the number of external associates involved in the teaching in order to reduce cost and we are in full support of this plan. This composition of academic staff versus students gives an approximate ratio of 1:10 which is well comparable with the leading international institutions in the field.
Teaching at the Faculty is covered by its own staff except some fundamental courses in Mathematics, Physics, and Physical and Health Education which is covered by a small number of external associates due to the teacher qualifications required. Physical and Health Education is mainly covered by external associates.
The assignment of the teaching load is carried out taking into account the involvement of a teaching academic in research, his/her research interests, his/her qualification, and experience. We have seen evidence of the concrete workload for all the staff which, despite following all relevant legislation, policies, regulations and collective agreements, is often very large leaving a limited time for research activities, especially, for young academics. We have also clarified that some of the high teaching workload in the evidence are voluntarily requested by individuals. We are entirely satisfied with the policies to assign the teaching load. However, we would encourage to balance better the teaching workload and consider the research ambitions of a young academic staff.

Recommendations for improvement
We recommend to improve the system of teaching load assignment.
Quality grade: **Satisfactory level of quality**

4.2. The higher education institution has an objective, transparent and excellence-based procedure of teacher recruitment.

Analysis

We are fully aware that political rules of the job complexity coefficient system in Croatia, which uses a constant sum of coefficients provided for each institution, drives the policy of recruiting new staff. Therefore, the Faculty is able to recruit only into positions that have become vacant because of a retirement or because of a departure of permanent staff from the Faculty. This fact largely limits opening of new positions in emerging areas of research in electrical engineering and computing. The Faculty solves this serious limitation in the recruitment by redistribution and re-grouping of the staff within the institution.

We are fully satisfied with procedures used to recruit new staff. The recruitment follows the Faculty development guidelines which are part of Development Strategy of the Faculty of Electrical Engineering and Computing of University of Zagreb 2013-2017. These guidelines of recruitment of new teaching staff fulfil the quality criteria required by a national legislation. The job criteria for academic staff including professors are available online to general public with a clear deadline, while the job application itself is done in writing to the institution. The criteria include a track record of an applicant with all relevant areas like research, project management, teaching, and feedback. The recruitment process is competitive, transparent, well-balanced with all relevant parties capable to assess excellence in research, teaching and administrative quality of a candidate.

Recommendations for improvement

We recommend considering to introduce an online job application system subject to a required legislature.

Quality grade: **High level of quality**

4.3. Teacher advancement and re-appointment is based on objective and transparent procedures.

Analysis

The promotion policy at the Faculty has to follow the so-called job complexity coefficient system which is a system where positions at higher education institutions are paid for from government budget. The Faculty has designed a promotion policy to create the conditions for academic staff in all fields of their work. The policy is based on teaching and research excellence, research funding, involvement in administration duties and also taking into account all other activities which benefit the institutions like involvement in a student recruitment, and promotion of science to public and media

and so. The selection process itself follows a tendering procedure using well defined criteria suitable for a particular position, and it is public. An execution of the selection is done by the Expert Committee which evaluates each candidate on the basis of the criteria of excellence. We have been entirely satisfied with the current procedures at the Faculty and found appropriate examples of promotion and progression. We are also happy with the attitude of the involved staff to achieve the best selection in the interest of the institution following its development plans.
We would like to note here that in our understanding the Faculty implemented the recommendation from the previous accreditation and developed better methods of cooperation with industry to support the postgraduate students within a real economic environment in Croatia.

Recommendations for improvement
None
Quality grade: **High level of quality**

4.4. The higher education institution provides support to teachers in their professional development.

Analysis
The Faculty provides numerous workshops on various topics including intellectual property, management, and modern teaching methods which are available to all academic staff for their professional development. We are especially keen to learn that a workshop helping to introduce a new staff into peculiarities and complexness of the Faculty working environment has been recently organised. This initiative has assured us that the attitude of the responsible personnel is to offer the best professional development to the staff which hopefully will benefit the development of the whole institution.
Academic staff which is identified as having issues in teaching quality, seen in student surveys, will be offered a professional development plan. The plan uses resources for organized and individual tutoring published on the website of the Faculty Committee for Quality Management. We are relatively satisfied with this approach but we would like to see additional measures to be used to enforce improvements in the teaching of individual courses if the teacher in question fails to tackle the issue.

Recommendations for improvement
We recommend to set up a dedicated web page listing all the workshops for professional development of the academic staff and teachers.
Quality grade: **High level of quality**

4.5. The space, equipment and the entire infrastructure (laboratories, IT services, work facilities etc.) are appropriate for the delivery of study programmes, ensuring the achievement of the intended learning outcomes and the implementation of scientific/artistic activity.

Analysis
We were reasonably satisfied with the infrastructure of the Faculty including teaching and research laboratories, IT services including hardware and software support, and all other facilities which are essential for the teaching delivery and achievement of the intended learning outcomes and research activities. Especially, we were impressed by the role and the scope of the Faculty's IT services with their dedicated server nodes and workstations including network.
We are assured that the Faculty management will pursue ways to upgrade and modernise the infrastructure and appeal on them to include these plans into overall development plan. In particular, we think that teaching labs with significantly outdated equipment, hindering the intended learning outcomes, should be identified and prioritised for an upgrade exploring ways for funding of the upgrades.

Recommendations for improvement
We do not give any formal recommendations here.
Quality grade: **High level of quality**

4.6. The library and library equipment, including the access to additional resources, ensure the availability of literature and other resources necessary for a high-quality study, research and teaching.

Analysis
The library facilities and resources are perfectly adequate. The library services fulfils both the needs of students for their teaching duties and research, the needs of academic staff and teachers, and the needs of conducting high quality research. We have seen all the library facilities and we are sure these are perfectly fit for purpose. We are also satisfied with the electronic resources, available to the students and staff, which are growing in usage. We have seen a willingness to adopt more electronic resources with the overall international trend. The procedures to acquire resources needed during the course of teaching development or research activities are effective and delivering. Finally, we have been impressed by the transfer of paper documentation into electronic form which is currently underway.

Recommendations for improvement - none
Quality grade: **High level of quality**

4.7. The higher education institution rationally manages its financial resources.

Analysis
The Faculty income consists of contributions from international projects, industry collaborations, funds from government budget, programme contracts, and scholarships. We are completely assured that the Faculty makes all reasonable efforts to manage and oversee its financial resources as closely as possible.
We are especially happy to see that the institution uses their own financial resources to encourage a development of new research ideas to promote further research activities and to help careers of a research staff. This policy naturally pays off by a success to develop large research projects and attract more research funding.

Recommendations for improvement
None
Quality grade: **High level of quality**

V. Scientific/artistic activity

5.1. Teachers and associates employed at the higher education institution are committed to the achievement of high quality and quantity of scientific research.

Analysis

The Croatian Agency for Science and Higher Education (AZVO) awarded the high quality label to the doctoral programme of Electrical Engineering and Computing, based on the re-accreditation procedure. The FER is committed to the achievement of high quality and quantity of scientific research, with five programmes based on internal regulation that support and encourage teachers and associates to reach the aim. The FER provided a list of publications categorised in accordance with the Ordinance on the Conditions of Appointment to Scientific Grades for the programme area and field.

Scientific publications of the FER teachers and associates are cited in international scientific databases (Web of Science Core Collection, Google Scholar, ResearchGate, IEEE Xplore) and with records maintained in the Croatian Scientific Database (Crosbi). According to the Web of Knowledge, the FER teachers and associates published 1484 Web of Science Core collection-cited manuscripts with 3256 citations (2642 independent citations), yielding organisation's h index equal to 23.

The FER's scientific activities are evident in the number and quality of completed PhD theses. The Faculty offers doctoral study in the area of technical sciences, scientific field of Electrical Engineering and scientific field of Computing, with the 33 PhD theses defended in the academic 2017/18 year, with 27 of them in Electrical Engineering and 6 in Computing. Observed imbalance in the number of PhD theses may be caused by external factors, such as fluctuations in the number of accepted research projects and markets that do not favour scientific workforce, but also by parallelism of the internal Faculty's structure that encompasses both the traditional and inflexible departments, and flexible research laboratories that easily adapt to technology development.

Professors and associates at FER actively promote scientific activities and disseminate scientific achievements at international and domestic conferences and in highly-rated scientific journals. FER encourages senior researchers, young researchers and students to publish their results in respected publications and conference proceedings using various internal and external programmes and schemes. Between 2013 and 2017, FER researchers published 1477 scientific papers in peer-reviewed international conference proceedings, according to the Croatian Scientific Bibliography (CrosBi). FER maintains records of participation in scientific conferences, as well as of the conferences and journals organised and published by the FER, respectively.

FER is committed to the forefront scientific practices of the open-access provision of experimental data and code used in research for the purpose of repeatability

assessment, as well as facilitation of the open access to scientific journals and the other publications of its teachers and associates.
Recommendations for improvement
None
Quality grade: **High level of quality**

5.2. The higher education institution provides evidence for the social relevance of its scientific / artistic / professional research and transfer of knowledge.

Analysis
Evidence, case studies and good practices were found and presented that show active and valuable contribution of FER in satisfying societal needs and resolving societal problems through engagement in targeted scientific projects at local, regional, national and international levels. Such activities also enhance the Faculty's visibility and recognition of efforts, competence and excellence.
FER has acquired a number of innovations and have been granted a number of patents during the involvement of its researchers in scientific projects. A dedicated faculty centre supports and monitors the patent activity.
FER monitor continuously the labour market in planning its research and society-supporting activities. The Faculty encourages the development of start-ups and spin-offs through a dedicated centre, and involvement in technology parks and business incubators. The Faculty organises dedicated employment events. The evidence is found of FER's engagement in professional, public, and advisory organisations and committees in both private and public sector. The Faculty supports local community through the involvement in workshops and round tables organisation, encouragement of volunteering activities, and the support to local professional (e.g. KoREMA, ELMAR, MIPRO) and civil society organisations.
FER popularises science and technology through the publication of popular science articles, media coverage of science and technology development presented by its researchers, and organisation of workshops, invited lectures and debates for the general audience. Records of those activities are maintained by the Faculty.

Recommendations for improvement
None
Quality grade: **High level of quality**

5.3. Scientific/artistic and professional achievements of the higher education institution are recognized in the regional, national and international context.

Analysis

FER researchers, teachers, associates and professional staff received numerous university, national and international awards for their scientific and professional achievements, for which the record is maintained on the Faculty information system. A number of respected scientists associated with the Faculty are members of the Croatian Academy of Sciences and Arts. Numerous examples reveal that teachers, senior and young researchers, associates, professional staff and students are recognised members of related respected national and international scientific and professional organisations (IEEE, Croatian Academy of Engineering). The Faculty awards recognition of scientific results accomplished by its teachers, scientists, professional staff, students and associates in the annual ceremony.

FER researchers run a more than just adequate number of internal, university, national and international projects with the appropriate funding (Croatian Science Foundation, University of Zagreb, H2020, FP7).

The Faculty's researchers, teachers, associates and professional staff give invited and keynote lectures at international and national conferences, and professional events in related scientific and professional field, as evident from the Faculty's information system. FER researchers, teachers, associates and professional staff are members of editorial boards of scientific journals, as well as scientific and professional boards of scientific conference and professional events. Evidence on the above-stated accomplishments is presented in the Faculty's information system.

Updating of all recognitions, memberships and the other above-stated activities in the Faculty's information system is the responsibility of every member of the Faculty staff.

Imbalance in the number of scientific projects has been observed across departments, with possible roots in imbalanced research and teaching load, attractiveness and global recognition of the observed scientific disciplines, and in parallelism of inflexible Faculty's internal structure and flexible and adaptable laboratories.

Recommendations for improvement

The Panel recommends that the consolidated lists of invited speakers, membership in conference organising committees and editorial boards, and awards and recognitions should be maintained at the overall Faculty level.

Quality grade: **High level of quality**

5.4. The scientific / artistic activity of the higher education institution is both sustainable and developmental.

Analysis
Former strategic documents related to scientific activity were well aligned, with detailed and consistent implementation of the strategic research agenda. Former strategies expired in 2017. New FER research strategy, as well as other strategic documents related to the institution, is now in the development process, led by recently elected management that is to take the helm of FER in autumn 2018. Commitment in enhancement and maintenance of scientific excellence is proven.
The Faculty awards recognition of scientific results accomplished by its teachers, scientists, professional staff, students and associates through a number or rewarding schemes on various levels (project group, department, faculty, university), and present them publicly (for instance: the FER Day annual ceremony). List of awards is maintained.
The FER facilitates and fosters scientific activities, and provides funding through various internal and external (national- and international-level schemes) through co-operation with professional and regulatory organisations and institutions. The Faculty also provides support, management resources and funds for human resources management (head-hunting, acquisition, collaborative work with external experts), equipment and literature procurement, space resources investments, dissemination of scientific results for scientists, professionals and general public, and supports (including funding) PhD studies of its employees.

Recommendations for improvement
The Panel recommends: restructuring the internal organisation of FER for sustainable scientific development, more efficient investments, enhancement of scientific productivity, human resources management, teaching and research quality advancement.
Quality grade: **High level of quality**

5.5. Scientific/artistic and professional activities and achievements of the higher education institution improve the teaching process.

Analysis
FER intertwines scientific and professional activities with its teaching process. However, the level of interdisciplinary and inter-departmental cooperation may impair the sustainability of the knowledge transfer process between scientific and teaching/education areas.

The Faculty arranges for balanced, efficient and optimised utilisation of laboratory resources (including equipment) for scientific (science, research, project execution) and teaching (course laboratory exercises, BSc, MSc, and PhD theses preparation) activities. Examples were shown when scientific activities resulted in methods and equipment used in laboratory exercises at all levels (BSc, MSc, PhD). BSc, MSc and PhD students are engaged in scientific activities, and recorded theses at all the levels resulted from this involvement. Students are encouraged and supported by both its advisors/mentors and by the Faculty to be involved in scientific activities in forefront technological development with a number of facilitating processes, including the funding support. Students at all the levels contribute to dissemination of results in scientific journals, at respected international conferences (including supported attendance), and in presentation of results to the general public. A list of students involved in scientific activities is maintained by advisors (mentors) and consolidated at departmental level. FER exceeds the standards of optimal utilisation of resources and student involvement in scientific activities.
The Faculty imposes measures and practices aimed at facilitation of gender equality and bridging the gender gap, in both areas (science and teaching/education). Evidence was found in support of equal opportunities for career development.

Recommendations for improvement
The Panel recommends the maintenance of consolidated and transparent list of students involved in scientific activities and their accomplishments at the Faculty level.
Quality grade: **High level of quality**

APPENDICES

1. Quality assessment summary

FER has a well-qualified academic staff undertaking a broad range of teaching, research and management activities. FER staff is accompanied by postgraduate research students, teaching instructors, and internal and external associates. FER offers two undergraduate study programmes, one in Electrical Engineering and Electronics and one in Computing Engineering, and three graduate programmes. The Faculty takes a large care in its management and planning. Consequently, FER currently transforms from the so-called FER2 programme to the FER3 programme in order to optimise the teaching process by reducing the number of external associates involved in teaching. At the moment, the ratio between the academic staff and the students is about 1:10 which favourably compares with world-leading instructions.

The teaching load is managed considering the involvement in research, particular research interests, expertise, and experience. The teaching staff is strongly encouraged to keep the quality of teaching on a high level by updating material, curriculum and labs but this effort is not consistent across the fields. This inconsistency results in a difference in quality and tensions between students and staff and among the staff itself and is a basis for many of our recommendations. There is also concentrated effort to improve teaching quality by acquiring an in-depth feedback from undergraduate, graduate and postgraduate students, and from the teaching staff which is recognised in our report. However, some of our recommendations originate from the fact that this feedback is not followed by appropriate actions and is often lost in the process. This also particularly involves equipment in teaching labs.

Finally, the panel emphasizes a very high quality of research carried out at the Faculty across several fields while recognising that there will be differences among fields which change in time. This very high quality of research is reflected in high-impact publications, participations at high-profile conferences, journal editorial boards and advisory bodies but, the most importantly, by a steady flow of research funding from national and European funding agencies. We therefore recommend an action to induce more flexibility in the internal organisation of units which would assure even better outcomes.

2. Site visit protocol

PROTOKOL POSJETA/VISIT PROTOCOL

Ponedjeljak, 23. travnja 2018./
Monday, 23rd April 2018

Hotel International

14:00 – 15:00 Edukacija članova stručnog povjerenstva – kratko predstavljanje Agencije, upoznavanje sa sustavom visokog obrazovanja u Republici Hrvatskoj/ Training for the expert panel members – short presentation of ASHE, introduction to the higher education system in Croatia

15:00 – 15:30 Edukacija članova stručnog povjerenstva – upoznavanje s Postupkom reakreditacije, Standardima za vrednovanje kvalitete, pisanjem završnog izvješća/ Training for the expert panel members – introduction to the re-accreditation procedure, standards for the evaluation of quality and writing the final report

15:30 – 15:45 Pauza/Break

15:45 – **19:00** Priprema povjerenstva za posjet Fakultetu elektrotehnike i računarstva Sveučilišta u Zagrebu (rad na Samoanalizi)/Preparation of the expert panel members for the site visit (working on the Self-evaluation)

Utorak, 24. travnja 2018./
Tuesday, 24th April 2018

9:00 – 10:00 Sastanak s dekanom, prodekanima i tajnikom *(bez prezentacija)/*Meeting with the dean, vice deans and secretary *(no presentations)*

10:00 – 10:15 *Interni sastanak članova Stručnog povjerenstva / Internal meeting of the panel members*

10:15 – 11:00 Sastanak s radnom grupom koja je priredila Samoanalizu /Meeting with the working group that compiled the Self-Evaluation

11:00 – 12:00 *Sastanak članova Stručnog povjerenstva* ***(Analiza dokumenata)****/Internal meeting of the panel members* ***(Document analysis)***

12:00 – 13:00 Sastanak sa studentima (otvoren sastanak za sve studente) / Meeting with the students (open meeting)

13:00 – 14:30 *Radni ručak Stručnog povjerenstva/Working lunch*

14:30 – 15:15 *Sastanak s Alumnima* / Meeting with the *Alumni*

15:15 – 16:00 Sastanak s vanjskim dionicima - predstavnicima strukovnih i profesionalnih udruženja, poslovna zajednica/poslodavci, stručnjaci iz prakse, organizacijama civilnog društva, vanjski

predavači/Meeting with external stakeholders -representatives of professional organisations, business sector/industry sector, professional experts, non-governmental organisations, external lecturers

16:00 - 17:00 Organizacija dodatnog sastanka o mogućim otvorenim pitanjima prema potrebi / Organisation of additional meeting on potential open questions if it is needed

Hotel International / Miramarska ulica 24, Zagreb

17:30 – 20:00 Sastanak Stručnog povjerenstva – refleksija o viđenom i priprema za idući dan posjeta/Joint meeting of the expert panel members – reflection on the day and preparation for the second day of the site visit

Srijeda, 25. travnja 2018./
Wednesday, 25th April 2018

9:00 – 9:45 Sastanak s prodekanom za nastavu / Meeting with the vice dean for teaching

9:45 – 11:45 *Sastanak članova Stručnog povjerenstva* ***(Analiza dokumenata)****/Internal meeting of the panel members* ***(Document analysis)***

11:45 – 12:30 Sastanak s voditeljima studijskih programa / Meeting with the heads of study programmes

12:30 – 13:15 Sastanak s nastavnicima (u stalnom radnom odnosu, nisu na rukovodećim mjestima / Meeting with full-time employed teachers (open meeting)

13:15 – 14:45 *Radni ručak članova Stručnog povjerenstva/Working lunch*

14:45–16:15 Obilazak Fakulteta (knjižnica, uredi studentskih službi, ured međunarodne suradnje, informatička služba, učionice) i prisustvovanje nastavi/Tour of the Faculty (library, student services, international office, IT services, classrooms) and participation in teaching classes

16:15 – 17:00 Organizacija dodatnog sastanka o mogućim otvorenim pitanjima prema potrebi / Organisation of additional meeting on potential open questions if it is needed

Hotel International, Miramarska ulica 24, Zagreb

17:30 – 20:00 Sastanak Stručnog povjerenstva – refleksija o viđenom i priprema za idući dan posjeta/Joint meeting of the expert panel members – reflection on the day and preparation for the second day of the site visit

Četvrtak, 26. travnja 2018./
Thursday, 26th April 2018

9:00 – 9:45 Sastanak s prodekanom za znanost / Meeting with the vice dean for research

9:45 – 10:45 *Sastanak članova Stručnog povjerenstva* ***(Analiza dokumenata)****/Internal meeting of the panel members* ***(Document analysis)***

10:45 – 11:30 Sastanak s voditeljima znanstvenih projekata / Meeting with the heads of research projects

11:30 – 11: 45 *Interni sastanak članova Stručnog povjerenstva / Internal meeting of the panel members*

11:45 – 12:30 Sastanak s asistentima / Meeting with teaching assistants

12:30 – 14:00 *Radni ručak članova Stručnog povjerenstva/Working lunch*

14:00–14:45 Organizacija dodatnog sastanka o mogućim otvorenim pitanjima prema potrebi / Organisation of additional meeting on potential open questions if it is needed

14:45 – 15:30 *Sastanak članova Stručnog povjerenstva/Internal meeting of the panel members*

15:30 – 15:45 Završni sastanak s dekanom, prodekanima i tajnikom/Exit meeting with the dean, vice deans and secretary

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16:30 – 20:00 Sastanak Stručnog povjerenstva - Izrada nacrta završnog izvješća i rad na dokumentu Standardi za vrednovanje kvalitete/Joint meeting of the expert panel members - Drafting the final report and working on the document Standards for the evaluation of quality

Petak, 27. travnja 2018./
Friday, 27th April 2018

Hotel International

9:30 Sastanak Stručnog povjerentva - Izrada nacrta završnog izvješća i rad na dokumentu Standardi za vrednovanje kvalitete / Joint meeting of the expert panel members - Drafting the final report and working on the document Standards for the evaluation of quality

12:30 Ručak /Lunch

3. *Quality grades by assessment area*

Quality grade by assessment area				
Assessment area	Unsatisfactory level of quality	Minimum level of quality	Satisfactory level of quality	High level of quality
I. Internal quality assurance and the social role of the higher education institution			X	
II. Study programmes				X
III. Teaching process and student support				X
IV. Teaching and institutional capacities				X
V. Scientific/artistic activity				X

4. Quality grades by standards

Quality grade by standard 1				
I. Internal quality assurance and the social role of the higher education institution	*Unsatisfactory level of quality*	*Minimum level of quality*	*Satisfactory level of quality*	*High level of quality*
1.1. The higher education institution has established a functional internal quality assurance system.			X	
1.2. The higher education institution implements recommendations for quality improvement from previous evaluations.			X	
1.3. The higher education institution supports academic integrity and freedom, prevents all types of unethical behaviour, intolerance and discrimination.			X	
1.4. The higher education institution ensures the availability of information on important aspects of its activities (teaching, scientific/artistic and social).				X
1.5. The higher education institution understands and encourages the development of its social role.				X

Quality grade by standard 2				
II. Study programmes	*Unsatisfactory level of quality*	*Minimum level of quality*	*Satisfactory level of quality*	*High level of quality*
2.1. The general objectives of all study programmes are in line with the mission and strategic goals of the higher education institution and the needs of the society.				X
2.2. The intended learning outcomes at the level of study programmes delivered by the higher education institution are aligned with the level and profile of qualifications gained.				X
2.3. The higher education institution provides evidence of the achievement of intended learning outcomes of the study programmes it delivers.				X
2.4. The HEI uses feedback from students, employers, professional organisations and alumni in the procedures of planning, proposing and approving new programmes, and revising or closing the existing programmes.				X
2.5. The higher education institution ensures that ECTS allocation is adequate.				X
2.6. Student practice is an integral part of study programmes (where applicable).			X	
2.7. Lifelong learning programmes delivered by the higher education institution are aligned with the strategic goals and the mission of the higher education institution, and social needs.				X

Quality grade by standard 3				
III. Teaching process and student support	*Unsatisfactory level of quality*	*Minimum level of quality*	*Satisfactory level of quality*	*High level of quality*
3.1. Admission criteria or criteria for the continuation of studies are in line with the requirements of the study programme, clearly defined, published and consistently applied.				X
3.2. The higher education institution gathers and analyses information on student progress and uses it to ensure the continuity and completion of study.				X
3.3. The higher education institution ensures student-centred learning.				X
3.4. The higher education institution ensures adequate student support.				X
3.5. The higher education institution ensures support to students from vulnerable and under-represented groups.				X
3.6. The higher education institution allows students to gain international experience.			X	
3.7. The higher education institution ensures adequate study conditions for foreign students.				X
3.8. The higher education institution ensures an objective and consistent evaluation and assessment of student achievements.				X
3.9. The higher education institution guarantees the issuance of Diploma Supplements and adequate qualification information.				X
3.10. The higher education institution is responsible for the employability of graduates.				X

Quality grade by standard 4				
IV. Teaching and institutional capacities	*Unsatisfactory level of quality*	*Minimum level of quality*	*Satisfactory level of quality*	*High level of quality*
4.1. The higher education institution ensures adequate teaching capacities.			X	
4.2. The higher education institution has an objective, transparent and excellence-based procedure of teacher recruitment.				X
4.3. Teacher advancement and re-appointment is based on objective and transparent procedures.				X
4.4. The higher education institution provides support to teachers in their professional development.				X
4.5. The space, equipment and the entire infrastructure (laboratories, IT services, work facilities etc.) are appropriate for the delivery of study programmes, ensuring the achievement of the intended learning outcomes and the implementation of scientific/artistic activity.				X
4.6. The library and library equipment, including the access to additional resources, ensure the availability of literature and other resources necessary for a high-quality study, research and teaching.				X
4.7. The higher education institution rationally manages its financial resources.				X

Quality grade by standard 5				
V. Scientific/artistic activity	*Unsatisfactory level of quality*	*Minimum level of quality*	*Satisfactory level of quality*	*High level of quality*
5.1. Teachers and associates employed at the higher education institution are committed to the achievement of high quality and quantity of scientific research.				X
5.2. The higher education institution provides evidence for the social relevance of its scientific / artistic / professional research and transfer of knowledge.				X
5.3. Scientific/artistic and professional achievements of the higher education institution are recognized in the regional, national and international context.				X
5.4. The scientific / artistic activity of the higher education institution is both sustainable and developmental.				X
5.5. Scientific/artistic and professional activities and achievements of the higher education institution improve the teaching process.				X