# UNIVERSITY OF ICELAND

## Faculty of Electrical and Computer Engineering

## SCHOOL OF ENGINEERING AND NATURAL SCIENCES

## SELF-REVIEW REPORT

June 2019


UNIVERSITY OF ICELAND

# Introduction

In accordance with the Icelandic Quality Enhancement Framework at the University level in Iceland and the University of Iceland's Guidelines for the organization, schedule and process of institution-led review of faculties and interdisciplinary programs, the Faculty of Electrical and Computer Engineering (the Faculty), School of Engineering and Natural Sciences (the School), University of Iceland (the University), carried out self-evaluation during the spring semester of 2019. The results are presented in this report. A self-evaluation committee was established in January 2019.

The committee members were:

1. Dr. Magnús Ö. Úlfarsson, Professor and Chair, Faculty of Electrical and Computer Engineering
2. Dr. Lotta M. Ellingsen, Associate Professor, and co-chair, Faculty of Electrical and Computer Engineering
3. Dr. Jóhannes R. Sveinsson, Professor, Faculty of Electrical and Computer Engineering
4. Dr. Helgi Þorbergsson, Associate Professor, Faculty of Electrical and Computer Engineering
5. Dr. Jakob Sigurðsson, Associate Professor, Faculty of Electrical and Computer Engineering
6. Dipl.Ing. Sveinbjörn Höskuldsson, Chief Technology Officer, Nox Medical.
7. Guðrún Hulda Ólafsdóttir, undergraduate student representative
8. Hans Emil Atlason, graduate student representative

The Committee used results of the data collection from University databases, student satisfaction results and focus groups' results, along with its own discussion and ideas to develop actions for improvement. The University of Iceland Centre for Teaching and Learning reviewed the Faculty's course catalogue descriptions, especially learning outcomes, and provided the Committee with that review.

The external industry representative attended Committee meetings, including during the visit of the international external experts. The industry representative provided comments that have been incorporated into the report.

This material was reviewed by the international experts who visited the School on March 19-22, 2019, and met with the Committee members. These were Polat Gülkan, Professor Emeritus of Civil Engineering at Middle East Technical University (Turkey), Rajeev Bansal, Professor of Electrical Engineering at University of Connecticut (USA) and Aletta Nylén, Assistant Professor in Computer Science at Uppsala University (Sweden). The international expert reviews were used to refine and finalize the resulting recommendations represented in this report.

## Faculty Characteristics

The Faculty of Electrical and Computer Engineering (ECE) is the only higher education entity in Iceland that educates Electrical and Computer Engineers at an undergraduate level. Ambitious academic programs are offered in electrical- and computer engineering at three levels: Undergraduate studies towards a BS degree, master's studies towards an MS degree, and doctoral studies towards a PhD. degree. Research in the Faculty of Electrical and Computer Engineering is carried out under the auspices of the Engineering Research Institute. Current faculty members work on a variety of theoretical and practical research projects in collaboration with business and institutions in the Icelandic professional sector. They are also quite active in the international research community. The Faculty consists of two departments [*námsbrautir*]:

- Department of Electrical Engineering
- Department of Computer Engineering

Each of the two departments offers its own area of specialization [*kjörsvið*], which carry the same names, Electrical Engineering, and Computer Engineering. Additionally, the third area of specialization has been offered from the fall of 2015: Medical Engineering [*læknisfræðileg verkfræði*]. The Faculty offers only one program [*námsleið*] at the undergraduate level, leading to a degree in Electrical- and Computer Engineering.

Administration of the Faculty is carried out by the Faculty Meetings and, between the meetings, the Head of Faculty. Faculty Meetings are conducted typically once or twice per semester. Records of meetings and documented work procedures are not well maintained or readily accessible, and this needs to be improved. The Faculty offers six study programmes at the undergraduate and graduate levels (Appendix 1, Table 1).

There are seven full-time faculty positions and one in 40% position within the ECE (7.4 full time equivalent, FTE) (Appendix 1, Table 2). Of these eight two are female. The majority of Faculty members have a doctoral degree in Electrical and Computer Engineering or closely related fields from high ranking North American Universities. Additionally, many faculty members started their career in Industry and have extensive experience working in a research and development environment within progressive companies in Iceland. Most of the faculty members are more than 59 years old while there is no one younger than 39.

The number of students and their progress through the BS programme (ROT261) is viewed as satisfactory by the Faculty with about 80 students in the programme and with about 18 graduates each year. There is about a 85% 4-year completion rate. (Appendix 1, Table 3). The MS programme (ROT441) has only had around 5 students in recent years, which poses difficulties for offering a full set of courses for these programmes. Similarly, the doctoral programmes have been attracting few students but in total seven students finished their .PhD degree in the years 2014-2017. In 2017-2018 the number of students was 153, thereof 138 undergraduate students, 12 master students, and 3 PhD. students.

# Summary and Main Conclusions for the Faculty

## Lessons learned from QEF1

The QEF1 Review resulted in a table of 45 items for improvement tasks. The responsibilities for these items were directed to faculty meetings (33 items), the faculty head (9 items), and to others (3 items). Deadlines for implementing the improvements were set for the beginning of the fall semester following the self-review, September 2015, (8 items), the end of the year (36 items) and in one case an other date. By 2018, two-thirds of the items were finished (8) or in progress (22), but little or no progress had yet been made on one-third (15).

The improvements that were readily finished soon after the review were primarily related to tasks that an individual teacher could implement in a course, such as strengthening programming instruction in a specific class, or improvements that were simultenously taking place at a university level, such as equality issues. Several of these improvements have been confirmed by numerous observations. Teaching surveys show a high level of satisfaction among first-year students entering the department, female attendance has increased from typically 5-10% to 40-50% in the time period from the QEF1 evaluation, MS enrollment has been increasing, half of the academic staff of the department have signed up for formal courses on university teaching, and half of those have already completed their studies in the area.

Improvement tasks that have had little or no progress are typically those that are related to functions outside the department, such as means for student funding, counceling, housing and facilities. Furthermore, tasks that have required extensive collaboration at the department level, such as coordinating coursework and grading, or setting department policies, tend to be left out in the implementation.

The largest number of improvement tasks was, and still is, in progress at various stages. This is to be expected, as many of these are long-term issues that inherently will be ongoing for a foreseeable future.

## Teaching and Learning

The ECE faculty regularly reviews its study programs with the aim of increasing its quality. This has resulted in a number of changes in recent years, e.g., 1) we have reorganized courses into Lecture parts and Laboratory/Computer Experiment part to even out the workload across courses, 2) We have founded Medical Engineering specialization. 3) We have founded sixths-semester, including courses in deep learning, medical engineering, and robotics and computer vision. Those courses involve relatively large course projects. 4) We have recently revised our MS program with the aim to have a stable and transparent course offering.

The ECE faculty scrutinizes the annual surveys of BS, MS, and PhD students. The results are discussed both within the Faculty and with students and dealt with accordingly.

The ECE faculty have set learning outcomes for all its courses and for its degree programs. The ECE faculty has identified that the MS program is a relative weakness and has already set plans in motion. This includes 1) making course offering more stable. 2) Establish an MS program in Remote Sensing that would be run jointly with the Faculty of Earth Sciences. 3)

Strengthen the renewable energy program. 4) Actively seek out collaboration with the industry with the aim of defining MS projects.

The ECE faculty aims to work with SENS in hiring a new ECE faculty in crucial areas such as electrical power.

## Management of Research

The ECE Faculty has not set a formal research strategy. The research strategy and research emphasis areas have been set by individual faculty members who have maintained vigorous research programs and groups, collaborated with researchers both internationally and nationally, actively sought out research grants, and published actively in peer-reviewed ISI-indexed journals and high impact conferences. This activity has resulted in a strong PhD program that the ECE Faculty will actively maintain and strengthen.

The ECE Faculty recognizes that a formal research strategy is desirable and is working on putting it together.

## Follow-up Processes

The Action plans have a “How” column that describes how the faculty intends to follow up the Action Plan. The self-review team along with the rest of the ECE Faculty will meet after the meetings with the Quality Committee to address their concerns.

The implementation of the Action Plan will be a standing item on meetings of the Faculty Board and similarly Faculty Head will report on the progress regularly to the School Board. Faculty Head reports formally to the School Dean on the status of the implementation and plans for next year together with other relevant QA matters no later than 1 December and this will be followed up in the School Board. The School Dean will subsequently make use of this report in a status report for all Faculties in the School, which will be submitted to the Quality Committee no later than 15 January. The Quality Committee writes a short report to the Rector no later than 1 February, which will subsequently be discussed in a meeting between the Chair of the Quality Committee, the Director of Quality Management and Rector, Vice-Rectors. Deans of Schools and the Managing Director of the Central Administration.

# Appendix 1. Key Figures.

**Table 1. Overview of present Study Programmes within the Faculty**

| Name of Study Programme | Cycle[1] | Degree | Credits (ECTS) |
|---|---|---|---|
| ROT261 Electrical and Computer Engineering | 1.2 | BS | 180 |
| TÆK261 Engineering Technology | 1.2 | BS | 210 |
| ROT441 Electrical and Computer Engineering | 2.2 | MS | 120 |
| TÖV561 Computer Engineering | 3 | PhD | 210 |
| ROT561 Electrical and Computer Engineering | 3 | PhD | 210 |
| RAF562 Electrical Engineering | 3 | PhD | 210 |

[1] See National Qualification Framework for Higher Education No. 530/2011.

**Table 2. Faculty members as of 1 September 2018 and sessional teachers 2017, number (No.) and full time-equivalent (FTE).**

| | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | No. | FTE | No. | FTE | No. | FTE |
| Professors | 3 | 3.00 | 1 | 1.00 | 4 | 4.00 |
| Associate Professors | 2 | 2.00 | 1 | 1.00 | 3 | 3.00 |
| Assistant Professors | 1 | 0.40 | 0 | 0.00 | 1 | 0.40 |
| Adjunct Lecturers | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Total | 6 | 5.40 | 2 | 2.00 | 8 | 7.40 |
| Sessional teachers | 11 | 2.34 | 1 | 0.30 | 12 | 2.64 |

**Table 3. Total number of students, number of entrants, retention rate for first year, and completion rate (4-year mean).**

| Programme | No. of students | | | No. of entrants[3] | Retention rate | No. of graduates | Completion rate[4] |
|---|---|---|---|---|---|---|---|
| | Total no. | Full time[1] | Part time[2] | | | | |
| ROT261 | 82 | 51 | 23 | 26 | 67 | 18 | 85 |
| ROT441 | 5 | 1.3 | 0.5 | 0.5 | - | 0.3 | 100 |
| TÖV561 | 0 | 0 | - | 0 | - | 0.3 | 100 |
| ROT561 | 1.3 | 1 | - | 0.3 | - | 1.5 | 100 |
| RAF562 | 0.8 | 0 | - | 0 | - | 0 | - |

[1] > 22.5 ECTS completed. For PhD students > 1 ECTS completed.
[2] 1-22 ECTS completed.
[3] For all programmes except PhD, no. of students completing at least one examination in first term.
[4] 2-year rate for diploma, 4-year rate for BA/BS, 3-year rate for MA/MS, 5-year rate for PhD.

**Table 4. Research output of Faculty members, based on the Evaluation System for the Public Universities in Iceland, expressed by mean total research points (A) and mean research points from peer-reviewed publications only (B) per FTE.**

| | 2014 | | 2015 | | 2016 | | 2017 | | Mean | |
|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B | A | B |
| Faculty | 72.3 | 60.5 | 50.8 | 42.8 | 32.4 | 28.5 | 48.1 | 39.9 | 50.9 | 42.9 |
| School | 41.8 | 31.6 | 43.4 | 32.4 | 39.0 | 29.7 | 39.1 | 27.5 | 40.8 | 30.3 |
| University | 31.7 | 24.1 | 37.8 | 24.7 | 37.1 | 25.1 | 34.8 | 22.8 | 35.4 | 24.2 |

# Appendix 2. Action Plan for Teaching and Learning and Management of Research in QEF2

| | Actions | How | Deadlines | Responsible party |
|---|---|---|---|---|
| **1. FACULTY LEVEL** | | | | |
| **Ch. 1.2** | **Faculty Characteristics** | | | |
| 1 | Hire a Professor in Electrical Power | Make a formal request to the Dean of SENS to hire the Professor | End of the year 2019 | The Faculty Chair |
| 2 | Hire a Professor in Medical Engineering | Make a formal request to the Dean of SENS to hire the Professor | End of the year 2020 | The Faculty Chair |
| 3 | Hire a Professor in Electronic Circuits | Make a formal request to the Dean of SENS to hire the Professor | End of the year 2021 | The Faculty Chair |
| **Ch. 1.3** | **Academic Vision** | | | |
| 1 | Define a research and teaching strategy | Use known methods to map out strategies such as VMOSA and seek to define and integrate research and teaching strategy | End of 2019 | The ECE Faculty |
| 2 | Encourage grant-seeking | Make the facility accessible for cooperation. ECE faculty supports and informs about all types of grants. | Ongoing | The ECE Faculty |
| **Ch. 1.4** | **Student Support** | | | |
| 1 | Organize a meeting for the 2nd year students regarding third-year elective courses | Contact students and set up a meeting | Fall 2019 | ECE Faculty Chair |
| 2 | Organize a meeting for the third-year students introducing them to the MS program | Contact students and set up a meeting | Mid to late March 2019 | ECE Faculty Chair |
| 3 | Closer cooperation between the ECE Faculty and the ECE student branch (VIR) and IEEE student branch | Organize a meeting between the ECE faculty and the student representative | Spring 2019 | ECE Faculty Chair |

**2. DEFPARTMENTS AND STUDY PROGRAMMES**

**2.1 ROT261 Electrical and Computer Engineering (BS 180 ECTS)**

| **Ch. 2.1.1** | **Students** | | | |
|---|---|---|---|---|
| 1 | Support student courses (Arduino, Python / Matlab /R, circuit building ) | Organize courses with the students' branches | Fall 2019 | ECE Faculty |
| 2 | Review carefully results from course evaluations | ECE Faculty meetings when course evaluation results are announced | Ongoing | ECE Faculty |
| **Ch. 2.1.2** | **Teaching and Learning** | | | |
| 1 | Review learning outcomes and coordinate courses | Faculty Meeting | Fall 2019 | ECE Faculty |
| 2 | Increase the amount of laboratory exercises | Have a Faculty meeting and identify where we can increase laboratory exercises | Fall 2019 | ECE Faculty |
| **Ch. 2.1.3** | **Coordination between teaching and research** | | | |
| 1 | The ECE faculty encourages use of Research students as TAs in undergraduate courses. | | | ECE Faculty Chair |
| 2 | Graduate students at the ECE Faculty give talks about their research aimed at undergraduate students | | | ECE Faculty Chair |
| 3 | Make the research conducted by the ECE Faculty more visible | | | ECE Faculty Chair |

**2.2 ROT441 Electrical and Computer Engineering (MS 120 ECTS)**

| **Ch. 2.2.1** | **Students** | | | |
|---|---|---|---|---|
| 1 | Increase number of students | Increase course offering, introduce | Fall 2019 | ECE Faculty |

| | | | | |
|---|---|---|---|---|
| | | Ph.D. research activity within the ECE Faculty. Have meeting BS regarding the MS program. Increase the ECE faculty members. | | |
| **Ch. 2.2.2** | **Teaching and Learning** | | | |
| 1 | Offer a new program regarding machine learning & Remote Sensing | Offer new courses | Fall 2020 | ECE Faculty Chair |
| 2 | Strengthen the Renewable energy line / Electrical Power | Hire a professor in Electrical Power | Fall 2019 | ECE Faculty Chair |
| 3 | Define MS projects with the Industry | ECE Faculty members contact Industry representatives in order to define relevant projects. | Ongoing | ECE Faculty Chair. |
| **Ch. 2.2.3** | **Coordination between teaching and research** | | | |
| 1 | Introduce the research done in the Ph.D. program to MS students | Organize Lectures held by the Faculty or Ph.D. students about their research | Ongoing | ECE Faculty Chair |
| 2 | Offer MS projects that could be the start of a Ph.D. project | | Ongoing | ECE Faculty |

**2.3 PhD Programmes**

| | | | | |
|---|---|---|---|---|
| **Ch. 2.3.2** | **Teaching and Learning** | | | |
| 1 | Review learning outcomes and coordinate courses | ECE Faculty meeting | Fall 2019 | ECE Chair |