

Submission date: 1/29/2020

Program/s in this review: Electrical Engineering (BS)

Specialized accrediting agency (if applicable): ABET

Campuses where the program is delivered: UAA

Members of the program review committee:

- Jens Munk, Professor & Department Chair, Program Committee Chair, UAA
- Joe Mixsell, Term Professor, UAA
- Todd Petersen, Associate Professor, UAA
- Matt Kupilik, Associate Professor, UAA

1. Centrality of Program Mission and Supporting Role (700 words or less)

The electrical engineering program at the University of Alaska Anchorage is committed to the University's mission to discover and disseminate knowledge through teaching, research, engagement, and creative expression. First, we strive to teach our students the fundamental principles of electrical engineering and important issues in engineering so they may pursue advanced degrees or enter the workplace as productive and competent engineering professionals. Second, the program seeks to further the profession of electrical engineering through professional activities and public service within the community, state, nation and society at large. Finally, the program engages in and disseminates research to advance the development of electrical engineering and provide innovative technological solutions to address the needs of modern society.

Faculty from the electrical engineering program teach courses in support of the Engineering Sciences program and the UAA Mechanical Engineering program. These courses include ES A309 (Circuits for non-electrical engineers), and ES A201 (Matlab for engineers). In addition EE faculty teach no fewer than 6 cross-listed courses, which include EE/CSE A241 (Digital logic), EE/ME 308 (Instrumentation), EE/PHYS 314 & 324 (Electromagnetics I and II), EE/ME A471 (Automatic Controls) and EE/ME A472/A672 (Advanced Linear Systems, which is also stacked as a graduate course in ME). CSE majors also take the following EE courses; EE A203, EE A333, and EE A353. A number of other EE courses can be taken by CSE majors as electives.

EE faculty collaborate with other UAA departments' faculty on numerous research projects

- Collaborations with CE and ME Departments on study of abrasion on bearings in hydrokinetic environments.
- Biomechanics, corrosion, renewable energy and other topics with ME faculty.
- Collaboration with Geology on geophysics related projects.
- Collaboration with Physics on plasma research and curriculum related issues.
- Collaboration with CS and CSE on numerous projects.

EE faculty at UAA have conducted external research with, but not limited to, the following entities:

- National Science Foundation – NSF (through Cornell Univ.)
- NOAA Sea Grant – with UAA CS
- Alaska Department of Fish & Game
- Numerous projects with UAF

- Alaska Department of Transportation (ADOT)
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. Department of Transportation
- Materials Measurement Working Group (A consortium of Faculty and researchers interested in measuring electrical material properties).

The State of Alaska Department of Labor and Workforce Development does designate engineering as a high demand job area (HDJA).

2. Program Demand (including service to other programs), Efficiency, and Productivity (7 year trend; 1400 words or less)

The EE department at UAA was initially part of the BSE (Bachelor of Science in Engineering), which included three sub-disciplines, or concentrations (Electrical, Mechanical and Computer Systems Engineering). It was difficult historically to keep track of which BSE students belonged to which concentration and accurate data prior to 2016 are difficult to come by. In 2016 the BSEE (Bachelor of Science in Electrical Engineering) at UAA was approved by the Board of Regents, and students had the option of updating their catalog year and graduating with a BSEE. It should be noted that the number of majors shown in the table above reflects only the BSEE students and not any BSE with the EE concentration. To date we have completed our teach-out of all BSE students.

The EE faculty enters the 2019-2020 AY with 5 full time faculty, down from a maximum of 7, which included absorbing a former Dean into our department who has since left the university. Beginning in AY 2020-2021 we will be down an additional faculty member, with the retirement of one of our colleagues bringing our number to 4 full time faculty. While this reduction presents challenges to the department, we are confident that with some adjustments, we can continue to deliver a quality education to our students. These adjustments will include cutting back on how often we offer several courses. The largest impact of this will be that students who need to repeat those courses will need to wait a year to retake them. Other adjustments include offering some upper division electives every other year, rather than once a year. Finally, we will continue to collaborate with colleagues at UAF in an effort to enhance the number of upper division electives available to both of our student bodies.

The difference between our Cost/SCH and Revenue/SCH is approximately \$115/SCH, which we expect will decrease in FY 2020-2021. Our FTES/FTEF ratios can also be expected to increase, despite a trend in decreasing enrollments. Many of our instructional productivity measures are efficient compared to the UAA averages, because we do enjoy healthy enrollment compared to the number of faculty in our department. These include SCH/FTEF (508.7 compared to a UAA average of 463.5), enrollment/FTEF (195.2 compared to a UAA average of 168.1), and FTES/FTEF (33.9 compared to 15.7). Our average class size is right in line with the UAA average.

3. Program Quality, Improvement and Student Success (1500 words or less)

The UAA Electrical Engineering program has been continuously accredited by ABET since 2007, two years after it formally started in 2005. Our most recent review was in 2016. The next general review is scheduled to take place in fall of 2022.

As faculty members, we strive to provide our students with a solid foundation in electrical engineering through our curriculum. As part of the ABET accreditation process, we are continually updating or revising the courses we include in our curriculum, be they required or upper division elective courses. Discussions regarding potential alterations to the curriculum occur over the course of the year, culminating with an annual assessment meeting, where any changes are finalized.

As previously stated, we have since our inception made a number of changes to the curriculum. This includes removing courses, adding new courses, and modifying course content, all with the goal of strengthening the program for our students. The faculty's focus has been and remains to provide a curriculum based upon electrical engineering principles, and to meet market needs. We have used our assessment process, which is a central part of our ABET accreditation process, to guide the changes and then to evaluate the outcomes from the changes. Results from our assessment process have shown that the changes that were made have materially improved our program.

In 2014 the electrical engineering faculty completed an Assessment Plan which documented the practices and procedures already in place and being used by the faculty in its annual assessment work. This plan was approved by the College of Engineering and the Faculty Senate's Assessment Committee and was on file in the Office of OAA. It served as the focus for the 2016 assessment review by ABET. The document was revised in fall of 2018 to comply with the new ABET standard. It was reviewed by the College's and the Senate's assessment committees and today is on file with OAA. The plan describes three sources of input that the faculty uses, faculty course assessment, graduating student input on mastery of learning outcomes and faculty performance, and data supplied by NCEES from the national FE exam. All of our key findings and actions taken have been documented in annual reports prepared by the EE assessment coordinator and are on file with OAA. There have been many changes made to improve the program. The best evidence that the UAA Electrical Engineering program has evolved into a strong program for our students is the standardized FE exam results. This exam is sponsored by NCEES and ABET. Since the program's beginning, 101 or 56% of our graduating seniors have taken the exam. It is not required for graduation, it is completely optional. Through spring of 2019, 88 students have passed on their first try or 87%. The national average of all students from ABET accredited programs passing is 72%. The UAA Electrical Engineering program is producing students who are excelling on this national exam which is evidence of the strength of the program.\

Our curriculum includes a number of labs, giving students hands on experience with state of the art equipment, while at the same time, reinforcing concepts presented in lecture. Our curriculum also includes a capstone course, wherein students assimilate a broad range of EE concepts to solve a design problem. Finally, for students interested in work experience we do offer class credit, for approved internships. In the past, internships have included both in state and out of state employers such as NASA, Tesla, Chugach Electric and BP to name but a few.

Prior to an engineering student declaring their major, EE, ME, CE, etc., the college's advising center is responsible for academic advising. Once the student declares their major, EE for example, they will be assigned a faculty advisor. Student are then required to meet with a faculty advisor prior to registration

each semester where the student and advisor discuss the student's progress in their program, the courses they will be taking in the upcoming semester, course loading, extra-curricular activities, and any topic that could affect the student's performance. With the faculty's approval the student is allowed to register for the subsequent semester.

Examples of Student accomplishments are given below:

- As we have previously alluded to, our pass rates on the FE exam are significantly above the national average (88% versus 72%), this despite the fact that we do not teach to the exam. We do however, use results from this exam to identify areas where improvements to our curriculum may be required.
- We have identified at least 10 of our graduates have gone on to become PE (Professional Engineers). This designation requires passing the FE exam, spending at least 4 years working under a PE, and finally passing the PE exam. It should be noted that the importance of PE designation in electrical engineering is largely dependent on the sub-discipline, however we also expect this number will increase as our population of graduates mature.
- To date, we have also identified at least 20 students who have gone on to graduate schools in STEM related fields. These fields include Electrical Engineering, Biomedical Engineering, Physics, Geophysics and Oceanography. Three former students have completed their Ph.Ds., while at least 4 others are in the process of completing their degrees. Graduate schools include, MIT, Dartmouth, The Ohio State University, the University of Michigan, the University of Illinois, the University of Florida, the University of California Irvine, the Colorado School of Mines, New Mexico State, Oregon State, and the University of Washington. Based on our total number of graduates, this puts us above the national average in terms of post-graduate education in STEM related fields. Moving forward, we believe that it is important that we promote not only the value, but the quality of an engineering education at UAA. We are proud to have been instrumental in the success of these students.
- In 2019 a UAA electrical engineering student was awarded the prestigious Goldwater Scholarship. The Scholarship recognizes this nation's next generation of leaders in science, engineering and mathematics. This award is the first for the UAA College of Engineering and likewise the first for the UAA electrical engineering department. It was the only such award given in the entire State of Alaska for 2019. The recipient will pursue a PhD. in plasma physics, and has narrowed his choice of graduate schools to Princeton, Stanford, or the University of Wisconsin Madison (1st choice).
- With over 80% of our graduates remaining in Alaska, and primarily within the Anchorage area, we are helping to meet the strong demand for electrical engineers locally. Over the past fifteen years we have graduated approximately 180 graduates, many of whom are now in senior engineering positions. We are proud of the well-earned reputation our graduates and our program now enjoy, and our honored to have been part of this process.

4. Program Duplication / Distinctiveness (300 words or less)

The EE faculty at UAA serve a comparatively large student body, primarily made up of students from Anchorage and the surrounding area. Despite a limited number of faculty, we have been able to deliver a quality product over the past 15 years. For example, our pass rates in the FE Exam (88% versus 72% for the national average), as well as the high percentage of our students who go on to graduate schools are all a testament to this. In addition our graduates (178 to date) meet a critical demand for electrical engineers in the state, as evidenced by their job placements. Nevertheless, the combined output of UAA and UAF EE graduates is not sufficient to meet the States need.

We see this unmet demand as an opportunity, and look forward to working with our colleagues at UAF to help close this gap. Beginning to 2016 we have been working with UAF to better align our curriculum, and to date have made excellent progress. This includes applying common courses numbers and course descriptions. One area where our curriculum do diverge is in our upper division offerings, which generally reflect the expertise of our respective faculty. Making these upper division courses available to both UAA and UAF students through distance delivery is one of our objectives moving forward. We see collaboration with our colleagues at UAF as a cost effective method of improving both of our programs, by extending opportunities to our students.

5. Summary Analysis (500 words or less)

Since 2017 the electrical engineering curriculum has remained essentially unchanged with the exception of offering elective courses mostly in the power and energy fields based on student interest. The last significant change made based on assessment data was the inclusion of PHIL A305, Professional Ethics, as a required GER for our electrical engineering students. The faculty also continues to monitor our student's next activity following graduation whether it be employment, attending graduate school, or other, as a measure of the program's success. This is one of our Program's Objectives, that is, to produce graduates with the training and skills to enter the job market or to continue their education by attending graduate school. Our data shows that our students' success in gaining employment is very high. According to EMSI data for our program for 2008-2019, approximately 93% of our graduates have remained in Alaska to work. We also have a number of students continuing their education in graduate school. One of our electrical engineering students this year was awarded the prestigious Goldwater Scholarship.

Moving forward, the UAA electrical engineering program is demonstrating its strength through the performance of our students in finding employment, pursuing a post graduate degree in graduate school, and/or through standardized testing like the FE exam results. By continuing the annual assessment activities, the faculty will look to continually improve upon the strong base that has been developed since the beginning of the program.