UNIT REPORT

Mechanical Engineering-Academic - APR Self-Study Report by Academic Unit/Department

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Program Mission

New Program Mission Item

Program Mission Statement:

Mechanical Engineering Program Mission

Program Mission Statement:

Our mission is to prepare students for entry into professional engineering practice and advanced study through our regionally-recognized program of high-quality instruction, integrated design and laboratory experience, and scholarship.

Program Goal (add a minimum of 3 program goal "plan items")

New Program Goal Item

Goal Statement:

Alignment to UI Strategic Plan Goals:

Indicators/Metrics to Evaluate Progress:

List of Actions the Program Will Take to Achieve Goals :

Goal Achievement Level:

Goal 1 - Scholarly and creative products

Goal Statement:

Upon graduation, students will have an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors.

Alignment to UI Strategic Plan Goals:

Innovate (Goal 1): Scholarly and creative products of the highest quality and scope, resulting in significant positive impact for the region and the world.

Indicators/Metrics to Evaluate Progress:

During the annual Engineering EXPO, each senior design team is required to present a poster, prepare a booth exhibit, and answer questions from fellow students, faculty members, public visitors, and EXPO judges. This is part of the culmination of the senior design experience. Booth presentations are scored by at least one volunteer judge(s) who are assigned by the capstone design director (Dr. Matthew Swenson) based on availability and disciplinary expertise. The judges are typically engineering industry practitioners and may be capstone project sponsors. Any project sponsors were assigned to groups that did not include their sponsored project(s) to avoid any conflict of interests. The judges are not faculty members, so their feedback provides an external, unbiased perspective on student work.

The scoring rubric uses a five-point scale with written anchors for level 5 (excellent presentation). Aspects of the design process interrogated through Design EXPO judging were: a) communication, b) concept development, c) solution realization, and d) solution impact. A score of one indicates students are able to provide only a cursory discussion on a specific aspect of the design process and is significantly below that expected of an entry-level engineer. A score of three indicates that students can adequately discuss a specific aspect of the design process. A score of five indicates that students are able to thoroughly discuss a specific aspect of the design process and is considered exemplary for an entry-level engineer. A copy of the EXPO booth judging rubric is appended to this report.

A breakdown of criteria grades into four expectation achievement levels is:
EXCEEDED: grades >= 4.5
MET: 3.5 <= grade < 4.5
PARTIALLY MET: 2.5 <= grade < 3.5
NOT MET: grades < 2.5

The total percent of teams in the achievement categories EXCEEDED and MET should be greater than 75%.

This year, the Design EXPO was presented in a hybrid format including in-person poster/booth presentations and virtual technical presentations via Zoom. The in-person poster/booth presentations involved limited audience and judge capacity due to social distancing restrictions, but these likely enabled judges to spend more time with each of the teams.

The average overall scores of 3.95 exceed the 3.5 target for MET. Furthermore, 14 teams (88%) earned overall scores greater than or equal to 3.5. Nine teams (56%) earned overall scores greater than or equal to 4.0. No teams had overall scores below 3.0. The area of "Solution Realization" was the highest rated, while performance was comparable across each of the other three areas (Communication, Concept Development, and Solution Impact). The area scoring with the lowest average was "Concept Development" at 3.81.

List of Actions the Program Will Take to Achieve Goals :
Despite the social distancing protocols, booth presentations were conducted in-person to a smaller audience of judges, faculty, and public visitors. Attendance was much lower than typical years, including some groups which were limited to only one judge due to availability.

The criterion for "Concept Development" was the most challenging for students, even though scores were still higher than prior assessments. Interestingly, each of the teams that scored below the 3.5 threshold in this category are teams that inherited projects which were continuations of prior capstone projects. As a result, these projects had pre-defined "concepts", thereby limiting the team's ability to generate new concepts from scratch. This may be one explanation for their lower scores.

One team scored below the 2.5 threshold for "Solution Realization" as noted in red in the table. It is not clear why this is, but records show that only one judge was available to evaluate the "Group A" projects. Therefore, this result is a reflection of only one judge's opinion. If more judges had been available, the average score would likely have been revised with more results.

Our aspirational goal to have more than 50% of the teams score above 4.0 in the Design EXPO Booth judging was achieved this year with 56%. With "Concept Development" continuing to be the lowest category, the instructors intend to pilot a Scrum-based approach in the first semester to better organize and streamline activities in Project Definition, Project Requirements, Concept Development, and Rapid Prototype. With better organization, students may have better content to draw from in presenting their posters and prototyping hardware in the booth presentations. We will continue to monitor the student teams' performance and take corrective if the aspirational goal is not achieved.

Goal Achievement Level: Met

Goal 2 - Contemporary Issues

Goal Statement:
Upon graduation, students will have an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Alignment to UI Strategic Plan Goals:
Engage (Goal 2): Suggest and influence change that addresses societal needs and global issues, and advances economic development and culture.
Indicators/Metrics to Evaluate Progress:
Each semester, the graduating seniors in mechanical engineering fill out an exit survey with 26 questions regarding the program. Some of these questions have relevance toward this learning outcome, therefore the answers to several questions have been used as tools in this assessment. Areas of focus for this assessment of goal achievement are involvement in professional organizations, the intent of taking professional exams such as the Fundamental of Engineering (FE) and Profession Engineering (PE) exams, and an ability to recognize relevant societal issues that require continuously improving engineering solutions. The evaluation metrics are defined as based on the number and type of answers for several questions in the survey. These questions are:

1. *Will you be involved in a professional/technical society?*
2. *Did you take the FE Exam? How helpful did you find ME 416 in preparing for this?*
3. *Are you planning on becoming a registered professional engineer (PE)?*
4. *Which contemporary issues do you consider most significant as you practice engineering?*

The metrics are defined as follows:

Question 1
EXCEEDED: if number of YES + MAYBE answers > 60% of respondents,
MET: 40% of respondents < number of YES + MAYBE answers < 60% of respondents
PARTIALLY MET: 30% of respondents < number of YES + MAYBE answers < 40% of respondents
NOT MET number of YES + MAYBE answers < 30% of respondents

Question 2
EXCEEDED: if number of YES answers > 60% of respondents
MET: 40% of respondents < number of YES < 60% of respondents
PARTIALLY MET: 30% of respondents < number of YES < 40% of respondents
NOT MET number of YES < 30% of respondents

Question 3
EXCEEDED: if number of YES + MAYBE answers > 60% of respondents,
MET: 40% of respondents < number of YES + MAYBE answers < 60% of respondents

PARTIALLY MET: 30% of respondents < number of YES + MAYBE answers < 40% of respondents
NOT MET number of YES + MAYBE answers < 30% of respondents

Question 4
EXCEEDED: at least 50% of respondents chose more than 7 contemporary issues
MET: between 40 and 50% of respondents chose more than 7 contemporary issues
PARTIALLY MET: between 30 and 40 % chose more 7 contemporary issues
NOT MET: less than 30 and 40 % chose more 7 contemporary issues

Overall Achievement level (on all four levels)
NOT MET – All four PARTIALLY MET or NOT MET
PARTIALLY MET – Three PARTIALLY MET or NOT MET
MET EXPECTATIONS - No more than one PARTIALLY MET and at least one EXCEEDED on all four questions
EXCEED EXPECTATIONS: Al least three EXCEEDED on all four questions

The target for meeting this goal was set as follows: no more than one PARTIALLY MET and at least one EXCEEDED on all four questions

List of Actions the Program Will Take to Achieve Goals :

The target was met during the review period. Students achieved the MET EXPECTATIONS level on questions 1, 2 and 4, and achieved EXCEEDED EXPECTATIONS on question 3. No PARTIALLY MET or NOT MET results were recorded. Therefore, it is concluded that our students have an adequate ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments by considering the impact of their actions and decisions in the global, economic, environmental, and societal contexts.

Since the target has been met, no additional action is required at this time. Continuous monitoring of student achievement levels will be performed during each Fall semester.

Goal Achievement Level: Met

Goal 3 - Educational impact

Goal Statement:

Students should establish themselves as competent communicators within a field or industry through the creation of clear problem definitions, generation of informative technical reports, participation in technical conferences/forums, and/or use of knowledge sharing technologies.

Alignment to UI Strategic Plan Goals: Transform (Goal 3): Increase our educational impact.

Indicators/Metrics to Evaluate Progress:

During the annual Engineering Expo, each senior design team is required to deliver an ~20-minute presentation to fellow students, faculty members, public visitors, and EXPO judges. This is part of the culmination of the senior design experience. The presentation should describe the design process they followed and demonstrate what the team accomplished.

The technical presentations are scored by at least two volunteer judges who are assigned by the capstone design director (Matthew Swenson) based on availability and disciplinary expertise. The judges are typically engineering industry practitioners and may be capstone project sponsors. Any project sponsors were assigned to groups that did not include their sponsored project(s) to avoid any conflict of interests. The judges are not faculty members, so their feedback provides an external, unbiased perspective on student work.

The scoring rubric considers categories of a) context, b) organization, c) evidence, d) visual aids and e) delivery. A five-point scale is used for each category with a written anchor for level 5. A score of one indicates an inadequate performance by the student team compared to a typical entry-level engineer. A score of three indicates that the team demonstrates adequate performance by an entry-level engineer. A score of five corresponds to an exemplary performance by the team compared to an entry-level engineer. The judging rubric and scorecard were provided and executed online, with judges filling out a questionnaire for each presentation after delivery.

A breakdown of criteria grades into four expectation achievement levels is:

- EXCEEDED: grades >= 4.5
- MET: 5 <= grade < 4.5
- PARTIALLY MET: 5 <= grade < 3.5
- NOT MET: grades < 2.5

The total percent of teams in the achievement categories EXCEEDED and MET should be greater than 75%.

This year, the Design EXPO was presented in a hybrid format including in-person poster presentations and virtual technical presentations via Zoom. Delivery on Zoom enables a much larger audience at the presentations. Judges continue to favor this format and suggest that we continue to use this format for the technical presentations every year.

List of Actions the Program Will Take to Achieve Goals :

As with the 2020 EXPO, all technical presentations were delivered via Zoom. This format enables much higher visibility to a broader audience and will likely be retained in future years (post-COVID). This format inherent allows for increased engagement, and judges have indicated that they can see the presentation slides better on Zoom than in person, which may be contributing to higher scores.

The criterion for “Evidence” continues to be the most challenging for students, although a large improvement in average scores (~10%) is observed in 2021. The one team that scored the lowest in “Evidence” is highlighted in red in the table above. This team has created a potentially patentable design for their external client, so the team needed to be very careful with how much information was presented to the public. As a result, it is not surprising that their score for “Evidence” (which was intentionally limited) was the lowest.

In the past year, more emphasis in class was applied for helping students articulate their project context and value propositions. Such efforts may have contributed to improved results in the “Context” category. This has become one of the strongest performance areas for students. Similar emphasis is being placed on creating solid Validation Plans, which appears to be improving the “Evidence” category.

In future capstone cycles, the plan is to continue the emphasis on validation plans and providing evidence of their results. For the 2nd semester of the capstone, the instructor team is looking at reducing the ancillary requirements for documentation, enabling students to focus more on building and testing their prototypes.

Goal Achievement Level: Met

Student Learning Assessment Report (add one "plan item" for each major, degree, and/or certificate offered by dept)

New Student Learning Assessment Report Item

Assessment Report Contact:
Program Changes in Past Year:
Learning Outcomes are Communicated to All Students in Program (check box if true):
Learning Outcomes are Communicated to All Faculty (check box if true):
Optional: Framework Alignment:
Import Outcomes Data (from Anthology Outcomes):
Summary of Student Learning:
Summary of Faculty Discussion:
Summary of Changes/Improvements Being Considered:
Inter-rater Reliability:
Closing the Loop:

B.S.M.E. - Student Learning Assessment Report

Assessment Report Contact: Gabriel Potirniche

Program Changes in Past Year:

Several curriculum changes were implemented during the period under review. These changes refer to:

1) Course change forms requesting updates of prerequisites, permanent numbers, and establishing an elective course on assistive robotics.

2) Our freshman design course ME 123 - Introduction to Mechanical Engineering design is being offered only one semester (fall only) instead of each semester.

3) A junior-level course on intermediate mechanics (ME 341) is being offered now both fall and spring. Until last year, the course used to be offered during fall only, which created some difficulties for students to line up their classes properly in the senior year.

4) Due to reductions in the teaching resources of the Department, certain courses are being taught by offering one section instead of two, or we reduced the number of sections, which led to an increase in the number of students in each section.

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment: ABET

Import Outcomes Data (from Anthology Outcomes):

1. Students will develop an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Students will develop an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. Students will develop an ability to communicate effectively with a range of audiences.
4. Students will develop an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Students will develop an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. Students will develop an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Students will develop an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Summary of Student Learning:
All student learning outcomes (SLO) have been assessed during the spring 2021 semester by the following means:

a. Evaluation reports of student performance in courses

ME 223 - Mechanical Design Analysis (SLO 1,2,3,5)

ME 301 - Computer-Aided Engineering (SLO 3)

ME 325 - Machine Design (SLO 6), ME 426 - Mechanical Systems Design II (SLO 1,2,3,5, and7)

b. Engineering EXPO presentations and judging (SLO 2,3)

c. Senior Exit Surveys in ME Department (SLO 4,7)

d. Fundamentals of Engineering (FE) Exam (SLO 1,4)

The SLO assessment reports have been uploaded in Anthology. Each report presents detailed findings (see Anthology Spring 2021 - BSME program). Achievement targets were set for all SLO assessments results. The targets were met during this review period in all SLOs. Therefore no corrective actions were recommended by reviewers of each SLO at this time.

Summary of Faculty Discussion:
The findings of the SLO assessment processes were discussed and the reports were approved by the ABET Committee of the Mechanical Engineering Department. The ABET committee approved the reviewers recommendations that continuous monitoring of the SLO achievement is performed each semester, and any corrective measures are undertaken if targets are not met in the future semesters. The SLO assessment results were also presented to and approved by the Mechanical Engineering faculty.

Summary of Changes/Improvements Being Considered:
None at this time. Targets were achieved for all SLOs; therefore, no changes or improvements to the actual assessment of learning are planned at this time.

Inter-rater Reliability:
The Mechanical Engineering ABET committee performs periodic reviews of the assessments that faculty members perform in our undergraduate program, and ensure that these assessments are consistent.

Closing the Loop:
The assessment process that we perform for the ABET program and summarized in the section on Student Learning offers us a complete view of the student performance and areas in which students do well, as well as areas in which we need to improve. By continued discussions and approval processes during faculty meetings, we ensure that recommendations by the ABET committee are communicated to faculty members and in subsequent semesters measures are implemented for improving the student learning outcomes.

Assessment is never complete, it is an ongoing process. Attached is our last ABET self-study, completed in 2019. The next ABET review will occur in 2025.

Attached Files
ABET-Report-2014-2020.pdf

M.S.-M.Engr - Student learning assessment report

Assessment Report Contact: Gabriel Potirniche

Program Changes in Past Year:
Several courses have been assigned permanent numbers in our catalog: ME 451/551 - Experimental Methods in Fluids and Thermal Sciences; ME 480 - Introduction to Programming. The GRE requirement has been adopted for admission in the M.S. program. No other program or curriculum changes were implemented in the last year.

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):
1) Problem-solving Skills - Graduates of the program will be proficient engineering problem solvers capable of identifying, formulating, and solving engineering problems by applying their knowledge of mathematics, science, and engineering.

2) Scholarship Skills - Graduates of the program will be effective mechanical engineers, capable of performing original scholarly work, while considering real-world constraints and the impact their solution may have on society.

3) Communication Skills - Graduates of the program will give effective oral presentations in professional forums and write for professional audiences. Opportunities should be pursued to speak in front of a larger technical community and to contribute to the published literature in the discipline.

Summary of Student Learning:
All student learning outcomes (SLOs) have been assessed during the spring 2021 semester using the following tools:

1) Problem-solving Skills - assessment of students in the ME 540 - Continuum Mechanics course that all students of this program are required to take.

2) Scholarship Skills - assessment of the research thesis (for the M.S. students) or the technical content of the graduation presentation (for the M. Engr. students).

3) Communication Skills - assessment of the defense presentation.

The SLO assessment reports have been uploaded in Anthology. Each report presents detailed findings (see Anthology Spring 2021 - M.S.-M.Engr. program). Achievement targets were set for all SLO assessments results. The targets were met during this review period in all SLOs. Therefore were no corrective actions recommended by reviewers of each SLO at this time.

Summary of Faculty Discussion:
The findings were discussed in the Graduate committee. The Graduate Committee approved these assessment reports. The conclusions were also presented to the faculty in the departmental meeting, and they were approved by the Mechanical Engineering faculty.

Summary of Changes/Improvements Being Considered:
None at this time. Targets were achieved for all SLOs, therefore no changes or improvements to the actual assessment of learning are planned at this time.

Inter-rater Reliability:
The same report template has been used continuously from semester to semester in ME 540 to assess SLO #1. SLOs #2 and #3 are evaluated by two rubrics created with input from all faculty members in the department. Faculty members have been informed on the procedures for filling out these rubrics, and detailed information is presented on how to grade student performance in each evaluated area.

Closing the Loop:
Over the last few years, these assessments have helped the Mechanical Engineering Department gain a better understanding of areas in which our M.S. and M. Engr. students perform well, and other areas in which they need to improve. For instance, it was observed two years ago that students lack an understanding of the importance of supporting their thesis' conclusions with data and quantitative results. The importance of this aspect has been underscored in several courses, such as ME 540 (Continuum Mechanics) and ME 501 (Graduate Seminar), and an improvement of student scores in the assessments performed was recorded this year. Our graduate committee closely monitors other areas in which students may underperform at times, and communication is performed with all graduate advisors and graduate students to take corrective measures and improve student performance.

Ph.D. - Student learning assessment report

Assessment Report Contact: Gabriel Potirniche

Program Changes in Past Year:
Several courses have been assigned permanent numbers in our catalog: ME 451/551 - Experimental Methods in Fluids and Thermal Sciences; ME 480 - Introduction to Programming. No other program or curriculum changes were implemented in the last year.

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):
1) Problem-solving Skills - Graduates of the program will be proficient engineering problem solvers capable of identifying, formulating, and solving engineering problems by applying their knowledge of mathematics, science, and engineering.

2) Scholarship Skills - Graduates of the program will be effective mechanical engineers, capable of performing original scholarly work, while considering real-world constraints and the impact their solution may have on society.

3) Communication Skills - Graduates of the program will give effective oral presentations in professional forums and write for professional audiences. Opportunities should be pursued to speak in front of a larger technical community and to contribute to the published literature in the discipline.

Summary of Student Learning:
All student learning outcomes (SLOs) have been assessed during the spring 2021 semester using the following tools:

1) Problem-solving Skills - assessment of students in the ME 540 - Continuum Mechanics course that all students of this program must take.

2) Scholarship Skills - assessment of the research thesis (for the M.S. students) or the technical content of the graduation presentation (for the M. Engr. students).

3) Communication Skills - assessment of the defense presentation.

The SLO assessment reports have been uploaded in Anthology. Each report presents detailed findings (see Anthology Spring 2021 - M.S.-M.Engr. program). Achievement targets were set for all SLO assessments results, and the targets were met during this review period in all SLOs. Therefore no corrective actions were recommended by reviewers of each SLO at this time.

Summary of Faculty Discussion:
The findings were discussed in the Graduate committee, and the Graduate Committee approved these assessment reports. The conclusions were also presented to the faculty in the departmental meeting, and the Mechanical Engineering faculty approved them.

Summary of Changes/Improvements Being Considered:
None at this time. Targets were achieved for all SLOs, therefore no changes or improvements to the actual assessment of learning.

Inter-rater Reliability:
The same report template has been used continuously from semester to semester in ME 540 to assess SLO #1. SLOs #2 and #3 are evaluated by two rubrics built with input from all faculty members in the department. Faculty members have been informed on the procedures for filling out these rubrics, and detailed information is presented on how to grade student performance in each evaluated area.

Closing the Loop:
Over the last few years, these assessments have helped the Mechanical Engineering Department understand the areas in which our Ph.D. students perform well and other areas in which they need to improve. Our graduate committee closely monitors other areas in which students may underperform at times and communication is performed with all graduate advisors and graduate students to take corrective measures and improve student performance.

Demand and Productivity

Demand and productivity

External Demand:
The enrollments in the B.S.M.E. program have decreased slightly between Summer + Fall 2020 (389 students) versus Summer + Fall 2021 (373 students). The freshman class indicates how enrollments will look in the upcoming years, has increased from Summer + Fall 2020 (72 students) to Summer + Fall 2021 (89 students). The percentage of UG students continuing from Spring 2021 to Fall 2021 is 93.3%, which is satisfactory. The course completion with passing grade rates are 95.1% (summer 2020), 85.9% (fall 2020), and 88.39% (spring 2021). To maximize these numbers, the Mechanical Engineering Department is taking measures such as (1) allocating mentors and TAs in undergraduate courses to help students with achieving their learning goals, (2) faculty members readily available to interact and guide students during office hours, (3) easy access to faculty members outside of office hours, (3) continuous monitoring of student progress during the semester, and using tools such as early warning grades and midterm grades, and (4) extensive access to hand-on and experiential learning which facilitates student success.

At the graduate levels - master's (M.S. and M.ENgr) and doctoral (Ph.D.) - Fall 2021 recorded a decrease in the total number of students enrolled (68) versus those in Fall 2020 (68). While it is a decrease, it is not a very significant one. One contributing factor for the diminishing of the graduate program is that some faculty members have retired or have moved to 0.5 FTE. Also, one faculty member did not have the contract renewed. All these reductions in faculty may have contributed to a decrease in graduate enrollments. It is expected that the graduate enrollments will increase in the upcoming year, as several research grants have been secured in our department, and that will translate to more graduate students being hired to perform research on external grants. In addition, several new graduate students will also be hired through the P3R1 program.

In the master's programs (M.S. and Ph.D.), there were 43 students enrolled in Fall 2021, versus 48 in the Fall of 2020. In the Ph.D. program, Fall 2021 recorded 17 students versus 20 in Fall 2020. The percent of continuing students in the graduate programs (both masters and doctoral) was 92.6%, which is high. Students in the graduate programs in Mechanical Engineering had an excellent record of completing courses with passing grades. The course enrollments completed with a passing grade varied between 94.93% (Spring 2021) and 100% (Spring 2020).

Internal Demand:
The credit-hour production numbers were as follows at the undergraduate level (B.S.M.E. program).

1. Summer 2020: 417
2. Fall 2020: 4,616
3. Spring 2021: 4,200
4. Summer 2021: 288
5. Fall 2021: 4,589

The breakdown by curriculum type of credit hour production during 2020/21 was 24.7 (General Education) and 75.1% (UG engineering). The credit hour production decreased slightly between summer/fall 202 and summer/fall 2021 due to a slight decrease in enrollment. Still, the positive aspect is that the freshman class this year is larger than last year, which will increase the number of credit hours.

The credit-hour production numbers were as follows at the graduate levels (M.S., M.Engr. and Ph.D.),

1. Summer 2020: 49
2. Fall 2020: 467
3. Spring 2021: 432
4. Summer 2021: 47
5. Fall 2021: 367

The credit-hour production has decreased slightly in 2021 compared to 2020, resulting in somewhat lower student enrollments in the three graduate programs.

Credit Productivity:
Mechanical Engineering Department has a significant credit hour productivity. This productivity is due to students' interest in mechanical engineering as a hands-on applied discipline and the employment opportunities after graduation. The strengths of our programs are the quality of our faculty members as instruction professionals (expert researchers and licensed professional engineers), their passion for teaching, and the long-standing tradition of quality undergraduate and graduate education in our department. We also benefit from a healthy ratio of research and undergraduate education. Students appreciate our program for combining robust analytical instruction with experiential, practical learning in mechanical engineering. They also enjoy easy access to faculty members and the availability of mentoring resources through undergraduate mentors and graduate TAs who participate in instructional activities alongside faculty members. Students also appreciate internship and co-op opportunities that are readily available with numerous engineering entities in our region. They highly value the professors' dedication to student success.

Perceived weaknesses are not having access to specific courses, which our department cannot offer due to fewer faculty members. Our current faculty members are teaching and performing research at their full capacity. Also, not having more student club projects is another perceived weakness. In Mechanical Engineering, the only active student club is the Clean Snowmobile Competition Club. Additional opportunities for students to get involved in club activities would be industrial robotics and automation.

From the feedback gotten from numerous interactions with various stakeholders and studying technological trends, the two main opportunities that the department can take advantage of long-term are (1) automation and robotics, and (2) aerospace engineering. The department is taking steps toward developing an industrial robotics laboratory, and in time, we hope to create a certificate in aerospace engineering. These implementations would involve taking advantage of some existing courses and establishing new courses that would address topics in these two fields. While some limited progress toward establishing such expertise areas relies on currently existing resources, it would be beneficial if additional human resources (Ph.D. students, postdocs, research and/or teaching staff and faculty members) can be allocated in the future. Such areas could have a beneficial impact on increasing the enrollments in our undergraduate program. It would align with some rapidly growing industry trends and areas in which prospective students are very excited about working.

The main threat would be to continue the downward trend in enrollments and the loss of faculty positions over the last few years. The primary way to reverse this trend is to invest in exciting and relevant educational activities that align our program with current trends in the economy and address the needs and desires of prospective students. Such exciting signature areas will make our program stand out from our competitors and make it a program that students want to join to get advanced, relevant education and an enjoyable experience.

Financial Health and Resources

New Financial Health and Resources Item

Financial Health:
The ME department is currently financially stable. Our needs on (i) infrastructure needs, (ii) compensation for temporary instructional needs and (iii) graduate student support are covered through a mixture of external gifts, certain sections of the general education budget and course/lab fees. At this point, the resources are sufficient to provide for a reasonable amount of infrastructure upgrades.

The main need of the Department is in the area of qualified instructional resources. Due to some contract non-renewals and retirements, starting with May 2022, our department will have only 10 faculty members who will be effectively involved in teaching courses. The greatest impact is felt at the graduate level, where the offerings of graduate courses in the area of solid mechanics, design controls, and computational methods will be extremely few next year. This creates problems for graduate advisors and graduate students in drafting study plans. This number of faculty members is historically one of the lowest, and it may have a negative effect on the overall quality of our program when it comes to both top-class education and significant research activities.

Efficient Use of Resources:
The infrastructure investments are coordinated and decided upon by the department's infrastructure committee. We also have a graduate committee that distributes funding resources for scholarships, teaching assistantships, and research assistantships. Priorities on investments are discussed in committees and general faculty and staff meetings in the Mechanical Engineering Department. Given the reduced number of faculty members, we

have been employing graduate students in several courses. We hope to hire temporary instructors to cover stringent teaching needs in the short term until the additional faculty positions become available.