

**UCC Program Review Committee
Summary of Review**

Program: Mechanical Engineering

This program includes the following degrees, minors, and certificates:

- Ph.D. in Mechanical and Systems Engineering
- Master of Science in Mechanical Engineering
- Bachelor of Science in Mechanical Engineering
- Bachelor of Science in Energy Engineering

Recommendation: This program is found to be viable. See this report for commendations, concerns and recommendations.

Date of last review: AY 2014

Date of this review: AY 2020

This report was shared with the department chair and the college dean. Their responses are attached.

This report was also sent to the Graduate Council who concur that the program is viable. Their comments are attached.

Ohio University Curriculum Committee
External/Internal Academic Program Review

Department of Mechanical Engineering

March 2020

Fuh-Cherng Jeng, Professor, Division of Communication Sciences and Disorders
Kristine Ensign, Assistant Professor of Instruction, School of Applied Health Sciences & Wellness
Karen Riggs, Professor, School of Media Arts & Studies
Edward Sabolsky, Professor, Mechanical and Aerospace Engineering, West Virginia University,
External Reviewer

The Department of Mechanical Engineering program underwent an external/internal program review site visit March 5, 2020. The Academic Program Review committee comprised Edward M. Sabolsky, external reviewer (Department of Mechanical and Aerospace Engineering, West Virginia University), and three internal reviewers, Karen Riggs (School of Media Arts & Studies), Kristine Ensign (School of Applied Health Sciences & Wellness), and Fuh-Cherng Jeng (Division of Communication Sciences and Disorders).

The committee met with departmental leadership, faculty, staff, undergraduates, graduate students, Russ College of Engineering Associate Dean for Academics Deborah McAvoy and Senior Associate Dean for Research and Graduate Studies Shawn Ostermann. The committee also toured the facilities in Stocker Center.

This report is divided into seven sections, directly organized as requested by the Ohio University Academic Program Review effort.

1. The program as a whole

- a. Is the current number and distribution of faculty sufficient to carry out the broad overall mission of the program?*

The current level of faculty is insufficient. Student-to-faculty ratio for undergraduate students is 39.5 to 1. Student-to-faculty ratio for BSME graduate students is 8.1 to 1. These ratios are the highest compared to the department's peer programs. The average student-to-faculty ratio for Mechanical Engineering programs in the United States, according to *U.S. News & Report*, is 11.2 to 1. The impending loss of a high-performing faculty member to another institution will increase the current ratio if the line goes unfilled. A second faculty position is "on hold" and it is not clear based on the current budget climate at Ohio University whether or when the line will be filled in the near

Department of Mechanical Engineering External/Internal Academic Program Review

future. Being down two faculty members will make it challenging for the Department of ME to carry out its mission.

- b. *Is the level of the program's RSCA appropriate for the program given the size of the faculty and the resources available to the program? Is the program's level of external funding at an appropriate level?*

Over the past seven years (2012-2019), the ME department were PI or Co-PIs of about \$13,320,910 in externally sponsored research. This amount averages \$1.9 million per year in external funding, and average of \$173,000 per faculty per year award over this time period. This is a reasonable rate for a ME department within a non-R1 research institution. This average funding rate is climbing toward that of a ranked ME department (about \$300,000 per faculty per year). With greater investment and growth in new assistant professors, this goal is achievable.

- c. *Is the level of service, outside of teaching, appropriate for the program given its size and the role that it plays in the University and broader communities it interacts with? Is the program able to fulfill its service mission?*

The service provided by the Department of Mechanical Engineering is appropriate and the program is currently able to fulfill its service mission. The Department has a deep commitment to community engagement. An example is the capstone design projects designed to help individuals, non-profits, and small business in the Appalachian region. Another example is working with state agencies such as the Opportunities for Ohioans with Disabilities.

- d. *Does the program have an appropriate level of financial resources, staff, physical facilities, library resources, and technology to fulfill its mission?*

The Department does not have the appropriate level of financial resources for physical facilities and technology. Technology funding is lagging, resulting in not enough and inadequate equipment compared with its peers. One area in need of attention is the area of materials property testing. For example, all mechanical engineering departments have at least two Intron Universal Mechanical Properties Testing Systems. This instrument is used to test the mechanical properties of materials (tensile and compressive strengths), and it is commonly used in both research and teaching. It is common for students to use this machine in both initial mechanics classes and labs and also in their research and student projects. The OU ME department has only one of these instruments, which is nearly 20 years old. This is just one instance where investment is required. Planning for physical facilities should be realized.

The Department badly needs a facilities person who would be available to repair equipment and assist in developing new instrumentation and testing fixtures. Currently,

the students, faculty, and undergraduate lab director appear to be attempting to fill in this position to maintain and fix equipment and facilities. This takes attention and time away from teaching and research. In addition, a facilities person assists a Department as the safety and chemical hygiene officer (CHO). The OU ME Department appears to have the undergraduate lab coordinator acting as the safety and CHO for both undergraduate programs and also all graduate research. This may be an overstretch given the duties he already serves, including teaching several classes per semester, and risks leading to a dangerous event.

2. Undergraduate Program

- a. *Is the program fulfilling its service role, adequately preparing non-majors for future coursework and/or satisfying the needs for general education?*

The Department fulfills its general education role by having faculty participate in interdisciplinary teaching. Its faculty stretch to carry out an accredited curriculum to serve its majors.

- b. *Is the program attracting majors likely to succeed in the program? Is the number of majors appropriate for the program? Is the program attracting a diverse group of students?*

Students come to Ohio University either intending to pursue ME or to explore various engineering programs. Students who ultimately pursue ME have a remarkably high, greater than 80%, retention rate. The number of majors seems appropriate for the program. The program would benefit from additional space or the ability to offer more sections as high course demand causes students to take courses out of the recommended order.

Most of ME's students are largely from the region, and many are first-generation college students. The Department admirably fulfills the institution's goal of serving students in Appalachian Ohio;

- c. *Does the undergraduate curriculum provide majors with an adequate background to pursue discipline-related careers or graduate work following graduation?*

The program has a remarkably high job placement rate, greater than 95%, for new graduates. Anecdotally, some undergraduate students do not feel confident that they are advised on how or why to pursue graduate work.

- d. *Are the resources and the number of and distribution of faculty sufficient to support the undergraduate program?*

The resources and the number of faculty are not sufficient to support the undergraduate program as discussed in section 1.a of this document. The undergraduate students expressed a desire for more lab space as did graduate students. Conversion of a vacant instructional faculty line to a lab coordinator position has helped but space remains tight, especially at the underclass level.

e. Are pedagogical practices appropriate? Is teaching adequately assessed?

The pedagogical practices are appropriate. The students would benefit from more and earlier hands-on and practical experiences. Teaching is adequately assessed through a variety of efforts, including the ABET accreditation process in which evidence must be provided to demonstrate achievement of ABET requirements.

f. Are students able to move into discipline-related careers and/or pursue further academic work?

The students are able to move into discipline-related careers and/or pursue further academic work as is demonstrated by a 95% job placement rate. Students report confidence in the quality of their degree. It is common for students from the undergraduate ME program to matriculate into the graduate BSME programs.

3. Graduate Program

a. Is the program attracting students likely to succeed in the program? Is the number of students appropriate for the program? Is the program attracting a diverse group of students?

The program is attracting students likely to succeed in the program based on a significant number of students successfully completing the qualifying and comprehensive exams. The number of students is appropriate for the program based on student feedback of access to faculty members. The program attracts a significant population of international students, but as is typical of the discipline, finds it difficult to recruit women and domestic underrepresented students.

b. Does the graduate curriculum provide an adequate background to pursue discipline-related careers following graduation?

The graduate curriculum does provide an adequate background to pursue discipline-related careers following graduation. Some students have difficulty in completing program requirements due to unavailability of courses. The students receive a large list of potential courses to meet requirements but find many of these have not been offered for some time. Electives offered outside the Department do not always complement their area of study.

- c. Does the program provide adequate mentoring and advising to students to prepare them for discipline-related careers?*

Faculty actively encourage students to pursue and collaborate on research as well as to present results at conferences and publish articles.

- d. Are the resources and the number of and distribution of faculty sufficient to support the graduate program?*

The graduate lab and workshops are inadequate for graduate students. Graduate students must work around the undergraduate students for resources in the workshops. The distribution of faculty research concentrations is evenly distributed across the four major areas, thermo-fluid systems, advanced materials processing, mechanics/mechatronics systems, and design & experimentation.

- e. Does the program offer appropriate financial support to graduate students?*

The Department is unable to offer appropriate financial support to graduate students compared to peer institutions. The Department provides funding for two years for doctoral students, additional funding must come from grants. The amount students are paid is based on the PI's level of funding.

- f. Are program learning outcomes adequately assessed?*

ABET learning outcomes are adequately assessed. The ME Department completes the typical practice of collecting evidence for all seven outcomes required for an ME Department. They specifically align certain outcomes to various classes within the curriculum and collect copies of the student work for those classes. The ME Department is efficient in not collecting copies from all assignments; faculty collect only evidence from assignments that specifically address required outcomes for the course. Evidence from a random selection of students is stored in folders for each class. The Department is instigating annual assessment reviews to ensure that all outcomes are successfully met.

- g. Are students able to move into discipline-related careers?*

It appears students are able to move into discipline-related careers. It is not well documented where graduate students end up upon degree completion.

4. Areas of Concern

a. Retention of junior faculty

A junior faculty member left the Department in 2019. Due to the current University climate, this faculty position remains vacant. Another productive junior faculty has accepted an offer from Cornell University and is leaving Ohio University at the end of this academic year.

b. Recruitment of women and underrepresented faculty

The Department has only one female faculty member, who is leaving the University in summer 2020. When this happens, the Department will consist only of male faculty members.

c. Limited undergraduate and graduate lab and workshop spaces

During the review period, students expressed their concerns about the limited workshop spaces that are available to undergraduate and graduate students.

d. Age of equipment and access to advanced equipment

As stated above, the mechanical properties testing equipment is quite limited and aged. Improvement in this area is important to make the Department more research competitive and to provide students experience in operating up-to-date equipment used in industry. This will make the students more competitive in the job market.

e. Limited availability of graduate electives

Currently, the Department's PhD policies require students to complete a large number of elective courses that are 7000 level or higher. Due to the shortage of faculty members, the Department is unable to provide a sufficient number of high-level elective courses for students.

5. Recommendations

a. Retention of junior faculty

The Department should be enabled to replace both faculty lines to maintain its research quality and reputation and to provide a sufficient number and variety of courses.

b. Recruitment of women and underrepresented faculty

The Department should continue its efforts to identify and recruit highly qualified female faculty. The Russ College should identify strategies to retain female and underrepresented faculty members.

b. Limited undergraduate and graduate lab and workshop spaces

The WUSOC building, once online, should alleviate space problems. In the meantime, efficiency within current spaces available in Stocker should continue to be pursued.

c. Age of equipment and access to advanced equipment

Testing the strength of different materials and mechanisms is integral to the undergraduate experience. The ME undergraduate students desire more lab opportunities where they can design and test, and these types of mechanical testing systems will directly provide those opportunities. The College should invest in resources needed for this missions, such as the purchase of one to two “Instron”-like universal mechanical testing systems (one for undergraduate teaching and for environmental research purposes). The Department should consider purchasing fairly inexpensive polymer 3D printers to encourage a new outlet of creativity by undergraduate students. A new, advanced 3D SLS metal printer was secured by ME faculty, but the funding to set up the printer seems to be lacking. This piece of equipment is rare and A key addition to the university (and actually, the surrounding business community who also would be interested in using it). Further assistance in quickly installing and making the system operable should be a priority.

e. Limited availability of graduate electives

An internal course audit to review how often and when courses are being offered at the graduate level to identify courses that might need to be offered more often or should be deactivated could be beneficial.

6. Commendations

a. Faculty dedication and commitment. The committee was impressed with the high-level of engagement and dedication of the faculty who essentially volunteer their time to assure positive student outcomes and productive research agendas. This level of commitment demonstrated by faculty demonstrates the importance of the Department in the development of Ohio University.

b. Responsiveness to students. ME students spoke highly about the ability to work in the collegiate and collaborative environment that the Department has provided for them. Students were enthusiastic about the quality of instruction and guidance they receive from faculty.

7. Overall judgment: Is the program viable as a whole?

The review committee found the Department of Mechanical Engineering to be **viable**, as evidenced by dedicated faculty, engaged and strongly motivated students that are well-prepared for the post-graduate marketplace, high-quality research publications generated by students and faculty, and strong research support garnered from extramural sources. Despite the shortage of faculty members and the limited resources and spaces available to them, the Department is performing efficiently and productively.



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April 2, 2020

Subject: Mechanical Engineering Department response to the Ohio University Curriculum Committee External/Internal Academic Program Review Report

We thank the review team for their good questions during the review visit and their helpful review report. Our responses are organized by report section

1. The program as a whole

Student / faculty ratio comparisons can be difficult to evaluate due to variations in numbers of service courses taught by other departments, non-faculty staff members, graduate programs, etc., but the point made by the review committee is valid – our faculty numbers are low compared to our peers.

The statement about lack of financial resources for physical facilities and technology is also hard to argue. Our budget challenges and the shift to the Ohio guarantee that eliminated student fees that funded department technology budgets have resulted in lack of investment in equipment and technology. The statement about a facilities person seems to leave out our machine shop coordinator who does work with our lab coordinator on equipment repair and safety in the shop, but it is still a valid concern.

2. Undergraduate Program

Lab space is an acknowledged issue given the current program enrollment, but we are likely to see a contraction of enrollment and we expect more space should become available when a new research building is completed. Until then we will continue to look for ways to maximize the use of the limited space available.

3. Graduate Program

The statement about unavailability of some courses is valid – our low number of faculty and high undergraduate enrollments has limited our ability to offer the range of courses, especially PhD level courses, that we would like to offer. We could take an immediate step of removing courses not likely to be offered in the next 3 years from our program catalog.

The statement that graduate lab and workshops are inadequate for graduate students seems to be driven by the fact that the department's machine shop and technician have a primary focus on undergraduates and there is no research-only shop. The new research building is expected to include a machine shop dedicated for research.

The statement that we are unable to offer appropriate financial support to graduate students compared to peer institutions is also one that we are trying to address. Departmental graduate student funding budgets have been shrinking, but faculty are increasing their grant budgets to increase RA stipends and attract good

students, and some faculty members are planning submission of GAANN proposals to increase PhD student funding.

The statement that It is not well documented where graduate students end up upon degree completion is also valid – we are attempting to get better data on an ongoing basis.

4,5 Areas of Concern / Recommendations

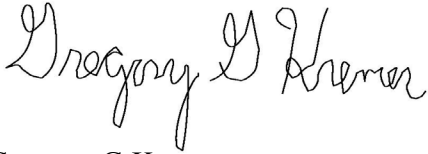
The concern about recruitment and retention of women and underrepresented faculty is one that we share. We made major investments in the last 6 years and attracted 2 high-quality women faculty who were successful and apparently happy in our department, but both left for good reasons that were beyond our control. We need to develop a sustainable plan for improving our diversity.

Although we have directed resources for setup of the advanced 3D SLS metal printer, several roadblocks have prevented us from having an operational system. We will raise the priority level to get it operational as soon as possible.

6,7 Commendations and overall judgment

We appreciate the supportive comments about our faculty and students – they truly are the heart of the program and put in great effort to make things work. And things do work well for the most part, but clearly could be improved with additional resources. We also appreciate and agree with the rating of our program as viable and the accompanying explanation.

Sincerely,

A handwritten signature in black ink that reads "Gregory G Kremer". The signature is written in a cursive style with a large, prominent 'G' at the beginning.

Gregory G Kremer
Robe Professor and Chair, Mechanical Engineering
Russ College of Engineering and Technology, Ohio University



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August 18, 2020

Ohio University
University Curriculum Committee

Re: Mechanical Engineering Program Review

We would like to thank the program review team for dedicating their time to the improvement of our Mechanical Engineering programs through the review of the undergraduate and graduate programs. We have reviewed the team's report as well as the response by the Mechanical Engineering Department Chair and include herein the response from the Russ College of Engineering and Technology Dean.

1. The program as a whole
The review team commented on the higher than average student-to-faculty ratio. The ratio is difficult to compare as the college has centralized many courses due to the overlapping requirements by several programs. For example, courses required within the Mechanical Engineering undergraduate program that are taught by college faculty include Career Orientation (0.5 credits), Engineering Graphics (2 credits), Programming (4 credits), Materials (3 credits), Statics (3 credits), Strength of Materials (3 credits), Dynamics (3 credits), Thermodynamics (3 credits), and Electrical Engineering 1 (2 credits). Other courses required in the program that are taught outside of the department include Statistics (3 credits), Electrical Engineering Lab (1 credit), Electrical Engineering 2 (3 credits), and Manufacturing and Design Laboratory (3 credits). Of the 127.5 credits required by the department, 32 credits include science, math and English requirements and up to 12 are Tier 2 General Education requirements. The remaining 83.5 credits are required within the college. Of these 83.5 credits, 33.5 credits are taught either by centralized college faculty or faculty external to the department. Therefore, the total number of credits taught by the Mechanical Engineering faculty are 50 credits for the undergraduate program, which is much lower than most of the other undergraduate programs within the college. Regardless of the above, the student-to-faculty ratio is higher than desired and if undergraduate enrollment increases the ratio will be even higher. Ultimately, it is critical to refill the faculty positions that were vacated within Mechanical Engineering.

In regards to the externally funding within the Mechanical Engineering Department, the average funding is slightly below the metrics set by the college for Group 1 faculty of \$250,000 per faculty per year. Substantial investments have been made by the college for start-up packages for assistant professors

within the Mechanical Engineering Department to help establish their research portfolio. Significant efforts have been made at the college level to help departments secure external funding, such as the newly created NSF Career workshops to assist junior faculty in obtaining NSF Career grants; connecting faculty with mission-driven funding agencies; connecting faculty with industry and pursuing industry-related funds; and promoting multi-disciplinary research.

Even considering the above information, we do not disagree that unfilled faculty positions within the department should be filled to accommodate the necessary breadth of coverage within the program, the advising load and externally funded research.

We also acknowledge the concerns with funding in regards to facilities and technology. The Russ College is currently in the design process for a new research building in order to expand research and graduate learning opportunities. Stocker Center was slated for a facility improvement prior to university funding issues at which time we were going to rehabilitate vacated research spaces for undergraduate learning opportunities. It is unclear as to the future of Stocker Center and the ability to upgrade the facilities to match our peers so we can be competitive at both the undergraduate and graduate levels.

In terms of the facilities personnel, the college does have a centralized individual to repair and maintain equipment, particularly in laboratory facilities. The college agrees with the review committee that the undergraduate laboratory coordinator is overstretched with teaching duties which should be conducted by faculty to allow the laboratory coordinator to focus on their main position.

2. Undergraduate Program

As stated above in section 1a, the college believes the departmental faculty lines should be filled but the credit hours required by the program are adequately filled by the current number of faculty due to the number of centralized courses taught by other faculty. Also stated above in 1c, the college is currently expanding research space in another building which should create availability within Stocker Center for innovative teaching spaces if funds are available for the facility update.

3. Graduate Program

While the review committee believes the number of graduate students is appropriate but has difficulty recruiting women and domestic underrepresented students, the college is working on increasing both the number of graduate students but also the number of underrepresented groups in addition to improved quality through strategic recruiting efforts.

The reviewers commented on the availability of courses for graduate students which is a concern with low numbers of graduate students enrolled in programs

with substantial breadth in the discipline. The depth available for graduate students is a balance between faculty workload of undergraduate course offerings, graduate course offerings, research and service. The college has recognized this across several of the engineering programs and have asked the chairs to reconsider the number of class requirements versus the capability of covering such topics through research investigations. In addition, many of the engineering programs within the college have synergies and chairs are investigating the potential for offering cross-disciplinary courses highlighting these synergies.

In terms of facilities for graduate students, it was discussed in 1c above that the college is in the midst of design for a research facility that will house graduate student laboratories, meetings spaces and offices. The college is also making efforts to create centrally shared facilities in order for faculty and graduate students to conduct cutting-edge research more efficiently.

The graduate student funding protocols are determined at the departmental level and some funds are provided to the department by the college for graduate student funding, both teaching assistants and research assistants. The college is embarking on an assessment of graduate student fund distributions to improve efficiencies based upon a combination of external funding, class sizes, and types of courses offered.

While the departments have developed standardized protocols to assess placement upon graduation with their undergraduate degree, many, including the Mechanical Engineering Department, have not yet focused these efforts at the graduate-level. The college believes these efforts are critical to fully assess the preparedness of the graduate students for their career.

4. Areas of Concern and Recommendations

Concerns regarding the retention of both junior faculty and underrepresented faculty within the department are echoed at the college-level. Recently, the Mechanical Engineering Department has exhibited difficulty in retaining high quality faculty regardless of the substantial funds the college has spent for start-up funds in the past five years. High quality faculty that establish themselves in research, particularly those that are underrepresented, are commodities within higher education at similar institutions, but also at more research intensive institutions. The department is working on a sustainable diversity plan to improve their efforts in this area. The college will continue to support incoming junior faculty members with substantial start-up funds within the department moving forward.

As discussed above, the college is in the midst of design for an additional research facility to increase space and needs for graduate students. Upon the completion of the research building, the college hopes to update Stocker Center to improve laboratory and innovative teaching spaces for undergraduate students. Both of

these endeavors will attempt to improve our competitiveness with state and regional institutions.

The college anticipates that the evaluation of the graduate curriculums will eventually improve the topic depth coverage that both students and faculty are seeking while also improving research opportunities at the graduate level within the Mechanical Engineering Department.

The college has also requested that departments reach across traditional boundaries and seek to share equipment where possible to avoid having some equipment sit dormant for periods of time while other entities could have been utilizing such equipment. The college is encouraging departments chairs to collaborate at a much higher level that has been done in the past to improve our efficiencies, both personnel-wise but also financially.

5. Commendations and Overall Judgment

The college highly values the Mechanical Engineering Department, both in their academic quality and their research quality. The level of community engagement the department provides is unmatched in the college. They have aided individuals, non-profit organizations and small businesses within the region and state and should be commended for such efforts.

We would like to thank the committee for the tremendous effort put forth to the improvement of the Mechanical Engineering Department.

Sincerely,

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From: [Yang, Lijing](#)
To: [Such, Barbel](#)
Cc: [Brooks, Gordon](#)
Subject: Program Review Comments for Mechanical Engineering from Grad Council
Date: Friday, October 9, 2020 4:12:49 PM

Hi Barbel,

The Program Review Subcommittee of the Grad Council met on Oct 9 at 2:30-3pm and presented the following comments to the GC meeting on Oct 9, 3-5pm. The GC members agreed that the Mechanical Engineering program is Viable.

We agreed that ME program did outstanding jobs in the following aspects:

- High retention rate: 80%
- High job replacement rate: 95%
- High level of engagement and dedication of faculty
- High quality of research publications of grad students

We shared the same concerns with the program review committee in the following aspects:

- Faculty shortage
- Retention of junior faculty
- Limited and Out-dated equipment and facilities
- Facility administration
- Lab space of undergrad and grad
- Availability of elective courses
- Diversity of faculty: especially from other countries

We also found Chair and Dean's responses are very constructive in the following aspects:

- While acknowledging the financial challenges during the pandemic, they decided to make significant investment in start-up fund for junior faculty
- Centralization of courses may address course selection and faculty course load issues.
- Expanding research space in another building should address facility management and lab space issues

We hope the ME program further clarify and address these issues:

- Graduate students only got two years' assistantship and then their pay scales vary by the faculty they work with. We are concerned that this will create inequity issues.
- We are not clear about role of grad students, especially PhD, in terms of research, teaching or administration. We are not sure whether graduate student resources might be helpful with the teaching and management issues in the program.

Please let me know if you have questions. Thanks!

Lijing

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