

Undergraduate Council Report on the Mechanical Engineering Program (Department of Mechanical Engineering)

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Introduction

The B.S. in Mechanical Engineering program at UMBC, administered by the Department of Mechanical Engineering, dates from 1985, when it was linked to a program at College Park. Since 1993, it has been independently accredited by the Accreditation Board for Engineering and Technology (ABET).

The B.S. in Mechanical Engineering is structured as a two-phase major: students begin as Pre-Mechanical Engineering majors and then move into the Mechanical Engineering major after they have passed a set of gateway requirements. During the period of review, fourteen tenured or tenure-track and three non-tenure-track faculty members supported 621 students. During the 2016-17 academic year the program had 102 graduates.

A. Student Learning Outcomes

The department has identified eleven learning goals for students in its program; these goals include an ability to design and conduct experiments; to identify, formulate, and solve engineering problems; and acquiring sufficient background to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

The process for evaluating the student outcomes was revised in 2015. In the new, more sustainable assessment plan, a faculty team (including the ABET coordinator) selected courses for assessment at each academic level (freshman through senior) and developed performance indicators and rubrics for each outcome in the selected courses. A corresponding schedule for the gathering and evaluation of assessment data was also established.

The learning outcomes are also periodically reviewed by an industrial advisory board established by the College of Engineering and Information Technology to ensure that the outcomes align with industry needs.

B. State of the Discipline; Program modifications; Program changes

The state of the discipline is not explicitly discussed in the report. Regarding program modifications and changes, there is a “continuous improvement” process in place to review student learning outcomes: if an outcome has not been attained at an expected level, data is collected using the performance indicators and assessment tools established for each course. Possible reasons for the shortfalls are then discussed and an action plan is developed, which may result in changes to a course. The suggested changes are then implemented in the next offering of the course and new assessment and evaluation is performed at the end of the two year cycle.

C. Undergraduate Curriculum

The curriculum requires students to apply principles of engineering, basic science, and mathematics; to model, analyze, design, and realize physical systems, components or processes; and prepare students to work professionally in the areas of both thermal and mechanical systems.

In order to ensure the professional competence of its graduates, the undergraduate curriculum in Mechanical Engineering requires 129 (rather than the standard 120) credit hours, broken down as follows: 37 credits in college-level mathematics and basic sciences (Biology, Chemistry, Physics) – courses which provide the foundation for more advanced courses in the junior and senior years; 62 credits in engineering sciences (47 credits) and engineering design (15 credits); and GEP courses, making up the remaining credits.

The Mechanical Engineering faculty is divided into four thematic areas: Thermal/Fluids, Solid Mechanics and Materials, Design Systems and Dynamics, and Bio-Mechanical Engineering. Faculty thematic area committees meet periodically to discuss the curriculum and associated prerequisites.

D. Research and Career Opportunities for Undergraduates

Students are made aware of scholarship, fellowship and employment opportunities. Individual faculty members also keep their advisees abreast of these opportunities, as well as opportunities for participation in their research projects. The department supports the Mini Baja and the Engineers without Borders undergraduate student projects. In cooperation with UMBC's Career Center, many students are afforded internship opportunities.

In addition, the Chair engages in meetings with industrial groups in specific areas to develop subprograms within Mechanical Engineering to meet their needs and develop employment opportunities for program graduates. Employers who have hired UMBC Mechanical Engineering graduates are surveyed for their impression of their preparedness for professional practice, as well as evaluation of the Mechanical Engineering objectives and outcomes.

E. Undergraduate Advisement

Pre-gateway students meet with an advisor in Undergraduate Student Services at least once a semester. After meeting the gateway criteria, students at the sophomore level receive group advising. On reaching junior status, students are assigned a Mechanical Engineering faculty member as an advisor. Each faculty member begins with 15-20 students, who remain with him/her until all have graduated (usually a two-year period). In addition to a review of academic progress, advising sessions include discussions of internship, research, and career opportunities.

Each student in the program is provided with an Undergraduate Handbook for Mechanical Engineering, which details for students all requirements, rules, course syllabi and Mechanical Engineering faculty members and resources that are available to guide them through the program.

F. Undergraduate Awards and Student Recognition

The report does not mention undergraduate awards or student recognition, but notes student chapters of the the following organizations: ASME, SAE, SWE, SBE and Tau Beta Pi. Mechanical Engineering faculty members advise these student organizations.

G. Faculty Development; Teaching Quality

During the period of review, the Mechanical Engineering Department successfully recruited five Assistant Professors. Each new faculty member receives start-up support for their professional

growth and for the development of their research laboratories. New assistant professors are assigned minimal service responsibilities while teaching only one course per semester during their first two semesters. A tenured/tenure track faculty member's effort is divided as follows: 55% teaching, 35% research and 10% service. Faculty who are active in research teach three courses per academic year. Faculty not active in research are expected to contribute to teaching or service to a higher degree. The Chair conducts an annual review of each faculty member regarding progress in research and teaching and makes appropriate recommendations.

H. Additional Comments; Summary Evaluation

While the growth in both undergraduate and graduate enrollments over the past decade had stabilized to around 500 undergraduates, enrollments have recently started to increase towards 600 undergraduates. The department finds that available resources have been adequate to handle this increase, and that there has been adequate support on the part of UMBC in pursuing its mission and educational objectives.

The program's continuing priorities include: (a) space for undergraduate student design realization; (b) increased graduate assistantship stipends to be more in-line with national averages; (c) increased administrative support; (d) faculty salaries at the Associate and Full Professor levels closer to its aspirational peers.

The ABET recommendations to the department were these: to incorporate engineering standards and multiple realistic constraints in capstone design projects, and a note that the program's existing advising control procedures are insufficient to identify and preclude students from enrolling in courses before all prerequisites have been met. After an appropriate response from the department, the Engineering Accreditation Commission (EAC) found that both these shortcomings had been satisfactorily addressed, and accreditation was extended through September 30, 2024.