Academic Program Review

External Reviewer Report

for the

Industrial Technology Program

at

Fitchburg State University

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Submitted By:
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External Reviewer:
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Introduction

a) Purpose of program review:

The purpose of the program review is to evaluate the self-study in the context of regional or national professional norms for the discipline.

b) Description of the visit:

The external reviewer conducted the visit virtually using Zoom on Friday, October 16, 2020 due to COVID-19 travel restrictions. Meeting sessions began at 9:30am and concluded at 4:00pm on the same day. The meeting sessions were conducted as follows:

9:30 am-10:00 am	Meeting with Dr. Keith Williamson, Dean of the College.
10:00 am -10:45 am	Meeting with Dr. Sanjay Kaul, Chair of the Department of Engineering Technology and Professor. D. Keith Chenot.
10:45 am – noon	Meeting with the Department of Engineering Technology's faculty: Drs. Kaul, Basu, Chenot, Mani, Mustafa, Yu, and Whitfield.
1:30 pm- 2:30pm	Meeting with Professor D. Keith Chenot and two students from the energy and the electronics concentrations.
2:30 pm -3:00pm	Meeting with Dean of the Library, Jacalyn Kremer, and Librarian, Ms. Connie Strittmatter.
3:00pm - 4:00pm	Exit interview meeting with Provost Alberto Cardelle and Dean Keith Williamson.

c) Data received prior to the visit:

The June 2020 version of the Industrial Technology program's self-study.

d) Data received post the visit:

Sample of core course syllabi, sample lab report, and copies of the new Engineering Technology program's four-year plans of study for each concentration.

Brief Description of the Program

- The Industrial Technology program, now named Engineering Technology, is one of three programs under the Engineering Technology Department. There are four concentrations available within the program: Architectural Technology, Electrical Engineering Technology, Energy Management Technology, and Manufacturing Engineering Technology.
- The transition from Industrial Technology to Engineering Technology addresses the regional needs.
- New curriculum was developed by following ABET standards.
- The students must complete 120 credit hours to graduate.
- There are 15 core courses including a senior capstone that are required for all students of the Engineering Technology program regardless of their concentration, mostly during the freshman

and sophomore years. This is an area of concern since the upper level courses are within the four concentrations.

- The program has 6 tenured and 2 tenure track faculty members.

Analysis of the Program and Recommendations

a) Curriculum and Assessment:

- Currently, the program has 7 student outcomes.
- Six faculty members are assigned as student outcome coordinators. Some faculty are assigned to two outcomes (Table F-2).
- Four courses were selected to be used for the assessment of student outcomes: ENGT 1700, ENGT 2020, CMGT 3035 (previously listed as ENGT 3035), and ENGT 4903 (Table F-3). None of the first three course have a laboratory component and the fourth one is a capstone course (Table E-1).
- The program establishes performance indicators for each student outcome and assigned course coordinators (Table G-4). It is to be noted that, according to ABET, the primary difference between student outcomes and performance indicators is that student outcomes are intended to provide general information about the focus of student learning and are broad statements of the expected learning, whereas performance indicators are concrete measurable indicators of achievement of the outcome. Table G-4 includes three courses different than the ones included in Table F-3: ENGT 2000, ENGT 2030 and ENGT 3025. The last two courses have 80% lab activities.
- Recommendations (suggested for possible input in a future self-study):
    - Revise the mission statement of the program to better reflect the regional needs that have been identified.
    - Revise the program educational objectives and obtain feedback from the program external advisory board (suggested below).
    - Revise the student outcomes and gather feedback from the program advisory board. Definitions can be found in the document *Criteria for Accrediting Engineering Programs:2019-2020* https://www.abet.org/accreditation/accreditation-criteria/
    - Include additional courses for outcome assessment.
    - In general, all of the performance indicators and assessment tools in Table G-4 should be reviewed to better reflect related outcomes. Table F-3 shows that all of the 7 student outcomes will be assessed using the capstone course ENGT 4903, while Table G-4 shows only 6. The Department should consider performance indicators and specific evaluation forms for the capstone course. For example, performance indicator 2 for the second outcome in Table G-4 seems more appropriate for ENGT 2020.
    - Perhaps an additional student outcome (outcome 8) should be added for each of the program concentrations.
        - A suggestion for outcome 8 might be as follows: an ability to apply engineering concepts to an area of concentrated study, chosen from architectural, electronics engineering technology, energy management, engineering technology, or manufacturing engineering technology.
        - Each concentration should have a specific version of outcome 8. For example, manufacturing engineering: graduates of the engineering technology program will demonstrate an ability to design and analyze integrated systems that include people, material, equipment, and energy.

- Establish a new department assessment committee that is responsible for:
  - Updating the assessment plan.
  - Preparing the annual report of the assessment.
  - Presenting results to faculty and advisory board.
  - Maintaining all of the assessment records.
- Ensure that course coordinators are:
  - Collecting the required assessment data.
  - Maintaining updated syllabi and course materials for course display.
- Assign concentration coordinators. They should be responsible for reviewing the assessment data relative to their concentrations and prepare annual summary.
- Suggested assessment methods (some already included in the program plan):
  - Direct measure of student outcomes:
    - Student work samples from selected courses (lab reports, oral presentations, specific assignments, targeted exam questions etc.)
    - Evaluation of capstone projects
  - Indirect measures of student outcomes
    - Student exit survey (outcome specific)
    - Student course survey (outcome specific)
  - Continuous improvement assessments
    - Student exit survey (general questions)
    - Student course survey (general questions)
    - Senior exit interview. Could be done by the chair of the department or assessment committee. Could meet with individual students or with groups.

<u>Laboratory component of the courses:</u>

- Laboratory experience is an important component of the Engineering Technology program's curriculum.
  - The fourth bullet under the program mission section (section C.4) states that the program prepares its graduate with "*an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes*."
  - Also, it is stated under section E.1 that "*Laboratory experiences in the program include electronics, mechanical measurements, computer aided design, materials testing, and hydraulic and pneumatic systems.*"
  - Table E-1 lists 8 courses with lab components. The percentage of the lab components can be 20%, 50%, or 80% and 100% in the senior capstone course.
- Laboratory activities are being taught as part of the regular courses. Based on the provided syllabi, lab activities can be between 25-40% of the course overall grade.
- Laboratory activities are not explicitly listed in the course syllabi.
- No engineering analysis found in any of the sample lab reports that were provided. It is to be mentioned that these reports were for the Industrial Technology courses so this could be the reason.
- It is recommended to:
  - Include a clear set of lab activities in the syllabus.
  - Require engineering analysis and interpretation of data in the lab reports.
  - Establish a set of measurable key performance indicators extracted from the student outcomes. According to ABET, the performance indicators should focus on the data collection process. The performance indicators should be communicated to the students.
  - Consider offering these laboratories as individual 1 credit hour courses.

An ABET example:
Outcome: Students should be able to conduct an experiment and interpret data
Performance indicators:
Students will be able to demonstrate the ability to:

- Follow the design of an experiment plan (knowledge);
- Acquire data on appropriate variables (application);
- Compare experimental results to appropriate theoretical models (analysis);
- Offer explanation of observed differences between model and experiment (evaluation).

Program Advisory Board

- The Engineering Technology program has no external advisory board, however there is a plan for establishing one. It is highly recommended that the program establishes one soon.
- The engineering Technology Advisory Board (ETAB) could be the primary organizational vehicle to represent regional government, industry, and employers in development and review of the program objectives, outcomes, and assessment results. This group should meet twice annually.
- The program assessment and evaluation plan might specify that the ETAB reviews the program objectives annually at the fall (or spring) meeting, along with related assessment data.
- ABET evaluators value the engagement of regional constituencies through the program's advisory board.

Additional Concentration in Environmental Engineering

There was a brief discussion during the meeting with the program faculty regarding the possibility of starting a new concentration in Environmental Engineering.

- In general, there is an increase in the number of employers who hire civil, coastal, environmental, and water resources engineers. The National Academy of Engineering has identified providing access to clean water, managing the nitrogen cycle, and restoring and improving urban infrastructure as three of their 14 Grand Challenges for Engineering in the 21st century. The US Bureau of Labor Statistics has predicted a 5-9% increase in civil, environmental, and marine engineering jobs from 2018 to 2028.
- This concentration might be a good opportunity for engaging undergraduate students in applied research projects from industry and from federal agencies that will contribute to student success. However, this might be difficult at this time with faculty average research time of 5%.
- It is important to clearly define the focus of this concentration based on the regional need. Also, a prediction of the number of students who will be interested in the concentration will be required. This can be achieved by sending surveys to the current students and to the alumni.
- An area that needs to considered carefully, especially in a general program, is the impact of this new fifth concentration on the enrollment in the other program concentrations, as students will most likely be from the same Engineering Technology program.
- Based on the current profile of the program faculty, there will be a need for additional faculty. This might be difficult to justify without a strong evidence of the increase of student enrollment from outside the program.

Students

- Students are excited about their concentrations and they see a great value in the core courses. Students are satisfied with the level of interaction. Students liked and appreciate the restructuring of the program. This is an area of strength.
- Students value professional organization. However, not many students participate in them. This could be due to small numbers in some concentrations, lack of interest, or lack of available time. One suggestion is to offer some of these activities through elective courses, or as a capstone project. ATMAE and ASME robotic competitions, SAE Baja car, can be some examples. They include design and engineering analysis that can be used to assess student outcomes. A lot of information and experience from other schools can be found in the ASEE publications.
- It was mentioned during the meeting with students that physics II is a repeat of the electronics class. This needs some arrangement with the physics department.
- Although the feedback was from two students only but, advising seems to be an area that needs improvement. Lack of communication between the student and the substitute advisor was mentioned.
- Students appreciated the opportunity to get their feedback during my meeting with them. It is recommended to engage students and collect their feedback in matters related to curriculum and assessment. This can be achieved by different ways, for example, some students can be invited to meet with the advisory board, it could be during lunch to provide informal feedback.

Resources and Support

Program

- Faculty and staff guided by the leadership of the Department Chair is a strength of the program.
- There is need for a high degree of engagement of regional constituencies to increase the strength of the program. This could be accomplished through the Advisory Board.

Faculty

Number of faculty seems to be adequate at this time.

- Currently, there are 8 full time faculty members in the program, 6 tenured, and 2 tenure track faculty with terminal degrees from education, visual arts, and different engineering disciplines including energy, construction, electrical, and mechanical engineering.
- The percentage of faculty teaching loads vary from 45% to 75% with 5% for research or scholarship.
- The majority of faculty have government/industry experiences ranging from 8 to 14 years and teaching experiences ranging from 9 to 35 years.
- Half of the program faculty members are highly involved with professional organizations.

- The faculty qualification table shows low consulting or summer work with industry. This could be an area that needs some attention. Faculty could be engaged with industry through applied projects that can be conducted by students under their supervision.
- Sufficient qualified faculty is important to the continued strength of the program. However, faculty development opportunities seem to be limited as presented in the self-study. Sabbatical leave is available to tenured faculty after a seven-year period of service, but other common faculty development programs seem to be not available. In the long term this could affect faculty competencies and compromise faculty recruitment.

Library

- The library resources are adequate based on the collected information during the virtual visit.
- The library has a healthy budget at this time and additional resources can be provided as needed.