Three-Year Check-In for New Programs

The creation and maintenance of graduate programs and certificates represents significant resource commitments by faculty and staff. Given these investments, in 2014 the Graduate Faculty Executive Committee (GFEC) established a “check in” process for newly approved programs and certificates prior to their first formal university review (which occurs in the fifth year.) Through this “check-in,” the GFEC hopes program faculty and staff will assess the implementation of their new program and determine what mechanisms may be needed for sustained student success.

Progress reports will be included on GFEC agendas, and program representatives may be asked to attend GFEC if additional information is requested. In the interest of brevity, please keep responses to 300 words or less.

Program Name
Power Conversion and Control Capstone Certificate

Term of First Enrollments
Fall 2015

Check-In Completed By
Professor James M. Tinjum

Date Completed
11/07/19

Academic Quality and Student Success

1. Provide an update on any changes to the program’s curriculum and learning outcomes. Include a description of the program’s typical course modalities (face-to-face, online, asynchronous discussion, team or individual assignments) and if courses have evolved based on faculty or student feedback.

The PCC curriculum and learning goals remain the same as that proposed in the plan approved by UAPC on February 19, 2015, and via the Curriculum Map (Table 1):

Curriculum (9–12cr) - List of required and elective courses and any other program requirements:

- ECE 411: Introduction to Electric Drive Systems (3 credits)
- ECE 412: Power Electronics Circuits (3 credits)
- ME 446: Automatic Controls (3 credits)
Learning Goals:

1. Analyze how torque and speed are controlled in the major classes of electric machines.
2. Evaluate how power electronics is used to perform electrical power conversion from one form into another.
3. Complete preliminary designs of automatic controlled systems using power electronics circuits.

Table 1: Curriculum Map

<table>
<thead>
<tr>
<th>Curriculum Map (Where)</th>
<th>Enter certificate-level learning goals and mark which course contributes to which learning goal.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capstone Certificate Program Courses</strong></td>
<td>Analyze how torque and speed are controlled in the major classes of electric machines.</td>
</tr>
<tr>
<td>ECE411 Introduction to Electric Drive Systems</td>
<td>X</td>
</tr>
<tr>
<td>ECE412 Power Electronics Circuits</td>
<td></td>
</tr>
<tr>
<td>ME446 Automatic Controls</td>
<td></td>
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</table>

The only change in the program is that more students are required to take the online version of ECE355 (Electromechanical Energy Conversion) as preparation for the full PCC program, particularly those students that may not have graduated from an ECE degree program. The course modalities continue to be online recorded lectures with online discussion sessions, both with faculty members as the course instructors-of-record and the assigned teaching assistants. Based on student and faculty feedback, the program is provided with a consistent minimum level of TA and grading support to support the learning environment.

2. Briefly explain the program’s learning outcomes assessment plan and discuss how you are or how you plan to evaluate student learning. Summarize any data collected to date showing evidence of student learning.

Assessment Planning is summarized in Table 2. Assessment information is reviewed annually with program faculty and staff at the annual Fall Faculty meeting. As each PCC course has examinations which are of similar structure and content to those administered to on-campus students, we have year-over-year data that shows the consistency and
measure of student achievement and evaluation for both online and on-campus delivery of these courses.

Because PCC students must have a minimum GPA of 3.33 to apply to the full online Power Engineering MS program, students that achieve the learning goals summarized in Table 1 tend to receive grades of B or higher and tend to continue into the full Power Engineering Online MS degree program. Approximately 60% of PCC students apply for the full MS program upon completion of the PCC Certificate.

Table 2: Assessment Planning

<table>
<thead>
<tr>
<th>Assessment Planning (How)</th>
<th>Analyze how torque and speed are controlled in the major classes of electric machines.</th>
<th>Evaluate how power electronics is used to perform electrical power conversion from one form into another.</th>
<th>Apply automatic control principles to regulate key performance variables in electric machines and power converters.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method for assessing learning (at least one direct method required)</td>
<td>Student course evaluation (indirect measure).</td>
<td>Student course evaluation (indirect measure).</td>
<td>Student course evaluation (indirect measure).</td>
</tr>
<tr>
<td>Examination (direct measure).</td>
<td>Examination (direct measure).</td>
<td>Examination (direct measure).</td>
<td></td>
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</table>

3. The GFEC is interested to learn how departments balance faculty and staff teaching loads and responsibilities between new and existing programs. Discuss how the department or program is achieving balance, and what challenges supporting multiple programs may have created for teaching, student services, advising or funding. Also of interest is information on what if any assets are shared between programs, or additional benefits that have been realized.

We have balanced and/or transitioned faculty and staff teaching loads in the delivery of the PCC Certificate in response to faculty retirements and understanding of the needs of faculty to teach on-campus courses. Furthermore, we provide significant TA and grading support at levels higher than on-campus classes given the unique delivery and nature of this curriculum in an online platform. Finally, the admission requirements for the PCC Certificate are strict such that unprepared students do not put undue burdens on the instructional staff. The following is a summary of how we balance the needs of faculty and teaching staff (see Table 3):

- For ECE411, Dr. Rich Schiferl is the instructor of record and, as an Adjunct Assistant Professor, was recently reappointed in the spring of this year for a 3-year appointment extension. As Rich is a very dedicated and popular instructor, this appointment assures the long-term sustainability, consistency, and ability to deliver this course online to PCC students. This course is taught online once per year.
• For ECE412, Dr. Stephen Fredette teaches this course. We have worked to deliver this course in parallel to on-campus delivery to minimize the load on the instructor. This course is taught online once per year.

• For ME446, Dr. Michael Zinn now teaches this course, which was historically taught by Dr. Neil Duffie. As Dr. Zinn also teaches a separate online course in Robotics each spring, we have removed ME446 as a Spring online offering in response to faculty load.

Table 3: Course Schedule

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 355</td>
<td></td>
<td>ECE 355</td>
</tr>
<tr>
<td>ECE 411</td>
<td>ECE 412</td>
<td></td>
</tr>
<tr>
<td>ME 446</td>
<td></td>
<td>ME 446</td>
</tr>
</tbody>
</table>

4. Please describe how your program has ongoing and broad faculty commitment, including governance, to ensure its continued success. If applicable, reflections from faculty and staff can be included here or as an appendix. Also consider if implementation of this program is supporting the Department and/or School/College’s current strategic goals.

Faculty leadership in this program includes Dr. Thomas Jahns as the Faculty Director and Dr. Bulent Sarlioglu as a core member of the Admissions Committee and director of numerous professional development short courses that serve as very effective marketing and promotion feeders into the PCC program. Further, this program is strongly supported by and in alignment with the Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC). The learning goals of the PCC Certificate are strongly in alignment with the objectives within WEMPEC to deliver research, outreach, and service in the newest technologies and techniques in electric machines, power electronics, actuators, sensors, drives, motion control, and drive applications. The ability of the PCC program to support TA and grading positions is a strength of the program with respect to faculty involvement, as routinely acknowledged by program faculty. As the mission statement of EPD is to

*provide engineering and technical professionals with the knowledge and skills to benefit their careers, industry, and society*

programs and certificates of this type are also in alignment with the strategic goals of EPD, which is now an office within the College of Engineering.
Operations and Administration

5. Illustrate how the program has either brought in NEW and ADDITIONAL students (required for non-pooled programs), and/or how overall enrollment in your related programs has remained steady. If unanticipated overlap with existing programs has resulted, discuss steps to mitigate the overlap.

In the Fall of 2015, we had 24 students in the Power Engineering online MS. In the Spring of 2019, we had 35 Power Engineering online MS students. This program growth is directly attributable to the implementation and delivery of the PCC Certificate. The PCC Certificate does not compete with existing programs, particularly as our online students are full-time professionals that work at companies such as United Technologies Aerospace Systems, Rockwell Automation, General Motors, Boeing, GE Healthcare, John Deere, and ABB.

Projections for annual enrollment in the PCC Certificate was 18 at the time of Certificate approval in 2015. As of the Spring of 2019, we had 25 active PCC Certificate students, which is higher than anticipated levels and reflective of program participation over the past several years.

6. Funding Considerations

a. For traditional/pooled programs – How is the program successfully funding its students?

Not applicable.

b. For non-pooled programs – Provide a brief summary of projected vs. actual revenues and expenses. Does the program have sufficient enrollment for sustainability? Discuss the current market outlook compared to the original marketing study, and plans to grow or change the program to become sustainable.

In FY17, FY18, and FY19, the PCC Certificate and Power Engineering MS were financially administered jointly due to the significant overlap in faculty, curriculum, and program director support. In addition, as there is significant overlap in coursework and students from the former online Control MS degree in Mechanical Engineering, some expenses and income from this separate degree program is included in the financials. Table 4 presents the revenues and expenses for this joint set of programs. As provided in Table 4, the overall PCC Certificate is part of an online platform of programs that is academically and financially successful with strong net positive financials.
Table 4: Financials including the PCC Certificate and Power Engineering

<table>
<thead>
<tr>
<th>FY</th>
<th>Income</th>
<th>Expenses</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>$528,832</td>
<td>$292,538</td>
<td>$236,294</td>
</tr>
<tr>
<td>2018</td>
<td>$610,219</td>
<td>$319,042</td>
<td>$291,177</td>
</tr>
<tr>
<td>2019</td>
<td>$538,796</td>
<td>$235,888</td>
<td>$302,908</td>
</tr>
</tbody>
</table>

7. If the program admits international students, describe how program processes address length of stay visa issues, online course restrictions, and needing ESL services.

Although the PCC Certificate does admit international students, it is an online program and thus visa issues and ESL services are not applicable.

8. Are there any issues impacting the program’s long-term sustainability? If so, what support would you like to help you succeed?

The PCC Certificate program has demonstrated financial sustainability and a three-year record of attracting and maintaining a student base of approximately 22 to 28 students per year. The program is somewhat self-limiting in growth because faculty leadership generally limits admissions to those students with an undergraduate degree in ECE (or equivalent) with sufficient academic preparation in core areas such as circuits, electrodynamics, and electromechanical energy conversion. As such, students with undergraduate degrees in Mechanical Engineering, for example, that are professionally transitioning into this field have difficulty with admission. Furthermore, a significant number (approximately 40%) of PCC Certificate students do not progress into the full Power Engineering online MS program, largely because of the rigor and time commitment needed to be successful in the PCC Certificate.

There is the possibility to expand the availability of online preparatory courses that would onboard students without sufficient ECE coursework (e.g., circuits, electrodynamics) to be able to participate in this program. *Electrification* is a significant grand challenge worldwide, and this PCC Certificate program could be a pivot point to provide the professional expertise necessary to advance the profession in this arena. If this growth arena was pursued, additional time and commitment of program director, marketing, and learning technologies support would be necessary to propel this growth.