December 12, 2014

Dear Members of the Graduate Faculty Executive Committee:

Engineering Professional Development (EPD) has worked with faculty across campus to develop a
new fully online program focused on Power Conversion and Control in engineering. As a result of
this work, we are submitting the attached proposal for a new Capstone Certificate for your approval.

The College’s first online Capstone Certificate provides the University of Wisconsin with an
opportunity to demonstrate its leadership in continuing professional development and engineering
education by offering a new academic credential for working engineers. Our analysis of potential
students has determined there is strong interest for credit-based continuing education after the
Bachelor’s degree focusing on the fundamentals of power and controls. This capstone will be our
opportunity to provide a bridge between non-credit engineering professional development courses and
the online Master of Science in Electrical Engineering (Power) and Master of Science in Mechanical
Engineering (Controls). These faculty and their associated departments will also share this new
revenue source.

Based on preliminary inquiries and with additional marketing, we expect to have between 15-20
students in the first set of classes planned for fall 2015. We expect enrollment of early and mid-career
engineers who are currently in professional positions or desire to move into engineering roles in power
electronics and controls of drives and electric machines. The program’s structure will allow students
to complete the degree program in one year while continuing to pursue their professional careers.

The College’s online graduate programs have maintained strong enrollment, and utilizing our past
experience with online programs as a guide, we are scaling-up our capabilities for faculty and student
support. We anticipate strong cooperation with the Division of Continuing Studies for these special
students, and expect this program to be financially self-supporting.

Please note, the CoE’s Master of Engineering Oversight Committee approved this proposal December
1, 2014, and the CoE’s Academic Planning Council approved this proposal on December 10, 2014.

Thank you for your consideration.

[Signature]

Professor James Blanchard
Executive Associate Dean, College of Engineering
Proposal for a Capstone Certificate in Power Conversion and Control (Fully Online)

1. Certificate Name and Academic Home

The College of Engineering seeks approval of a new online Capstone Certificate program in Power Conversion and Control. The Department of Engineering Professional Development (EPD) will be the academic home for the certificate, with EPD Program Director Marty Gustafson serving as primary contact. The faculty director of the certificate will be Thomas Jahns (Department of Electrical and Computer Engineering (ECE)). EPD’s existing distance degree team will provide student services (Director Gary Henderson) and student progress tracking (Program Associate Julie Wiest), with additional support from EPD’s technical services (Paul Miller) and appropriate faculty (Robert Lorenz and Neil Duffie from Mechanical Engineering (ME) and Giri Venkataramanan and Steven Fredette (ECE)).

This capstone will provide instruction in power conversion, power electronics and control systems for students with a B.S. in Engineering that work or desire to work with electric machines and drives. Credits from the completed capstone certificate (with grades of “B” or higher) can be applied toward the M.S. in Mechanical Engineering (Controls) or M.S. in Electrical Engineering (Power Systems) online degree programs if the student applies for, and is accepted into, either program after completion of the capstone.

2. Timeline for Implementation

This program will be offered to special students beginning with the Fall 2015 semester. We anticipate enrollment of at least 10-12 University special students in the first year. This is the approximate number of current University special students in online courses from ECE and ME each fall that are interested in this particular subject. This certificate intends to meet the desire of these students to gain a credential for their additional training in this subject area, and reach out to new students that are not interested in pursuing a full masters degree.

3. Support Letters

Letters of support from the College of Engineering, Department of Engineering Professional Development, Department of Mechanical Engineering, and the Department of Electrical Engineering are attached at the conclusion of this document, along with faculty support. As this certificate is in a niche area of engineering, no overlap with other academic units exists.
4. Governance

The existing EPD distance degree team currently supporting University Special students in online Electrical and Mechanical Engineering courses will manage operation of this Capstone Certificate. Program Director Marty Gustafson will act as primary contact for students and faculty, with responsibility for faculty support, course scheduling and finances. Academic Director Professor Thomas Jahns will serve as faculty advisor. Gary Henderson, EPD’s Director of Student Services, will lead the admissions process and tracking of satisfactory progress, including coordinating completion notices to the Registrar. He will be assisted by EPD’s Program Associate Julie Wiest for student support during registration and exam proctoring.

EPD’s Credit Programs Committee, led by Distance Degree Director Wayne Pferdehirt, will conduct department governance. A newly established capstone committee, consisting of the program’s faculty, EPD Program Director and EPD Student Services Director, will hold additional responsibility for admissions decisions and yearly advisory review. This committee will also work with the Division of Continuing Studies Special Student admissions coordinator (Jane Schimmel) to receive applications and review student classifications.

The initial planning of the capstone was conducted by a larger working group with members from EPD, ECE, ME and WEMPEC that support the online M.S. in Electrical Engineering (Power Systems) and M.S. in Mechanical Engineering (Controls) programs. This group meets quarterly and includes a number of ECE and ME online program faculty, the EPD Program Director, the WEMPEC director and administrator, ECE and ME graduate student coordinators, ECE graduate admissions coordinator, EPD Student Services, EPD Credit Courses Director, ECE Graduate Curriculum Committee Chair, and when available, the corresponding Department Chairs. This broad involvement representing many aspects of student, faculty, department, College and industry interests has resulted in a capstone with strong College of Engineering support.

5. Purpose, Rationale and Justification

For over forty years the Department of Engineering Professional Development has provided continuing non-credit education and outreach in power and controls to working engineers. The department supports a robust non-credit outreach short course schedule to meet the demand of hundreds of students per year (Table 1 shows EPD’s typical non-credit outreach course offerings).

| Table 1. Typical Non-credit EPD Courses in Power Electronics and Rotating Machinery Courses |
|---------------------------------------------|----------------------|
| Course                                      | Date                |
| Intro to Electromagnetic Interference and Compatibility & Best Practices | Oct 21-23, 2014     |
| Introduction to Electrical Machines and Drives | Mar 24-26, 2015   |
| Introduction to Electrical Energy Storage Devices and Systems | Apr 7-9, 2015     |
| Introduction to Power Electronics            | Apr 14-16, 2015     |
As this technical area continues to rapidly evolve, many alumni from EPD’s short non-credit courses later decide to explore credit-based academic opportunities in power and controls. Because UW-Madison offers online Master’s of Science degrees in these subject areas, many of these working engineers enroll as “Special Students” in order to access these online courses. In fact, in a typical semester, over 20 special students are enrolled in power or controls courses from the Department of Mechanical Engineering and the Department of Electrical Engineering (Table 2).

Table 2. Fall 2014 Students Enrolled in MS-EE (Power) and MS-ME (Controls) Online Credit Courses

<table>
<thead>
<tr>
<th>Student Type</th>
<th>MS-EE Power Courses</th>
<th>MS-ME Controls Courses</th>
<th>Total Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special</td>
<td>13</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Graduate</td>
<td>31</td>
<td>17</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>26</td>
<td>70</td>
</tr>
</tbody>
</table>

Given this high demand for credit-based education in this field, the new Capstone in Power Conversion and Control will serve three purposes:

1. It provides a respected UW-Madison credential for working professional engineers that need specialized instruction in the fields of power electronics, machines, drives and converter controls that they did not receive at the undergraduate level.
2. It creates a “stepping stone” for students interested in continuing education beyond non-credit seminars, but that are unsure how to fit a Master’s Degree program into their schedules.
3. It prepares students with insufficient backgrounds for the online M.S. in Electrical Engineering (Power) and M.S. in Mechanical Engineering (Controls) programs by introducing foundational concepts and courses.

Additionally, there is strong support for credit-based continuing education opportunities in power and controls from the 80+ corporate sponsors of the Wisconsin Electric Machines and Power Electronics Consortium (www.WEMPEC.engr.wisc.edu). WEMPEC’s sponsors include both large corporations (ABB, Boeing, Carrier, Caterpillar, Chrysler, Delphi, Dyson, Eaton, GE, Generac, GM, Halliburton, Harley-Davidson, Hitachi, John Deere, Johnson Controls, Kohler, Magna, Miller Electric, Moog, Nissan, Oshkosh, Plexus, Rockwell Automation, Rolls-Royce, Samsung, Texas Instruments, Toro, Toshiba, Toyota, Trane, TRW, UTC Aerospace, Whirlpool and Yaskawa) and small industry leaders. The ability to provide outreach opportunities for its members was the driving force behind the online MS-EE and MS-ME programs when they began in 1985, and their members have continued enrollment for almost 20 years. This capstone program, should it be approved, will be formally launched at the annual WEMPEC meeting in May 2015.
Finally, this capstone follows the mission of educational innovation on campus, which seeks to “build innovative professional Master’s-level degrees and other lifelong learning opportunities” that will “expand the reach of UW-Madison...throughout the state, nation, and the world.” This program will represent the first graduate capstone program for the College of Engineering, and should it be successful, EPD will consider additional capstones to meet the continuing educational needs of working engineers.

6. Curriculum

The Power Conversion and Control Capstone curriculum was designed to be completed in three consecutive terms of three credits per term, and consists of the three foundational electrical and mechanical courses for students in the power electronics, machines, drives and controls industries (Table 3).

Table 3. Capstone Certificate in Power Conversion and Control – Curriculum

<table>
<thead>
<tr>
<th>Course</th>
<th>Instructor</th>
<th>Credits</th>
<th>Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 411: Introduction to Electric Drive Systems</td>
<td>Professor Thomas Jahns</td>
<td>3</td>
<td>Fall</td>
</tr>
<tr>
<td>ECE 412: Power Electronics Circuits</td>
<td>Professor Giri Venkataramanan (Backup: Steve Fredette)</td>
<td>3</td>
<td>Spring</td>
</tr>
<tr>
<td>ME 446: Automatic Controls</td>
<td>Professor Neil Duffie</td>
<td>3</td>
<td>Fall, Spring, Summer</td>
</tr>
</tbody>
</table>

Each course in the capstone program is offered online on a regular basis and will not require changes to anticipated course offerings. Additional instructional support (Faculty Associate Steven Fredette) can also be utilized for the ECE courses if needed during sabbatical, and a similar back-up instructor will be identified for the ME course.

Enrollment in each course currently varies from 10-15 students, providing room for additional students should the program grow beyond the current special student population. Each professor also has a teaching assistant and/or grader assigned to support the online student population, and in some cases, the TA is providing online live discussion with students on a weekly basis (ECE 411). Department and faculty support letters are included in the appendix.

7. Overlap Limits

The Capstone Certificate in Power Conversion and Control is designed to overlap with the M.S. Electrical Engineering (Power) and M.S. Mechanical Engineering (Controls) programs currently offered at a distance from the College of Engineering. The capstone curriculum covers foundational courses in both programs so students that wish to continue from the capstone into the graduate degree can...
do so (if qualified). Students accepted into one of these online M.S. programs will be allowed to apply these nine credits to the M.S. programs if they receive a grade of “B” or higher.

8. Assessment and Program Review

Students that complete this Capstone certificate will be expected to articulate the key performance measures, design components and analysis methodologies in the specialized field of power conversion and control. These include the ability to:

- Articulate the key objectives of a controlled electric drive system
- Analyze performance metrics of an electric machine or power-driven system
- Complete preliminary designs of automatic controlled systems using power electronics circuits

In order to meet the program learning outcomes, three fundamental courses that introduce theoretical concepts and engineering methodologies were selected with the following individual learning goals:

**ECE 411: Introduction to Electric Drive Systems**
- Develop and quantify common performance objectives for the application of adjustable-speed drive systems employing power electronic converters and ac or dc machines.
- Analyze the operation of an electric drive system given rated speed and torque using voltage control.
- Identify the physical structure and principles of operation of dc machines.
- Determine operating characteristics for balanced and variable frequency of induction machines.
- Determine operating characteristics for balanced and variable frequency of synchronous machines.

**ECE 412: Power Electronics Circuits**
- Develop and quantify common performance objectives for power electronic circuits, such as efficiency, power factor, etc.
- Develop simple dc-dc power electronic converter topologies to meet certain functional specifications.
- Analyze dc-dc power electronic converter operation to develop design guidelines for choice of switching devices and reactive elements.
- Identify and use switching device and reactive component performance characteristics to apply them appropriately in dc-dc power electronic circuits.
- Complete preliminary design of inductors and transformers.
- Describe steady state and dynamic behavior of dc-dc power electronic converters using equivalent circuits, matrix models and small signal transfer functions.
- Design simple closed loop regulators for dc-dc power electronic converters to meet functional objectives.
- Identify and synthesize general circuit topologies to realize inverters and rectifiers for single
phase and three phase applications.

- Describe operation of diode and MOSFET based power electronic circuits.
- Use mathematical analysis/simulation software tools to solve engineering design problems.

**ME 446: Automatic Controls**

- Develop and quantify common performance objectives for automatic control systems that form a system configuration that provides a desired system response.
- Model using block diagrams or process models simple goal-oriented automatic controls systems.
- Complete Laplace transforms to determine final values that simplify the behavior of a system.
- Predict the closed-loop frequency response, gain and phase margins of a system.
- Analyze the sensitivity of a closed-loop system.

These courses are currently offered in two different online degree programs, and after each offering are assessed using EPD’s standard course evaluation practices, including an end-of-semester online evaluation of each course by students and a post-course evaluation completed by the instructor. The evaluation survey completed by the students focuses on the student’s perception of their achievement of course learning outcomes, helpfulness of the instructor(s), course format and logistics, and applicability of course material to current and projected professional applications. EPD’s program director, faculty and instructional systems specialist review course metrics and discuss updates and changes as needed. The evaluation completed by course instructors addresses the instructor’s perceptions of student performance, his/her satisfaction with course logistics and related support, and plans for modifying course content or logistics before next offering of the course. Results from student and instructor course evaluations are reviewed by the program director, course instructor, and instructional design staff to collaboratively plan and schedule course updates and revisions.

On top of assessment of individual courses, upon completion of the capstone certificate a program evaluation will be sent to students. This program assessment focuses on the program-level outcomes and student’s expectations for using their knowledge in the workplace. As a general practice, EPD would also like to send an additional assessment to graduates of the capstone several years after completion to test student expectations against ongoing performance.

Another assessment procedure that uses the course and program evaluations is a new plan to internally review of each EPD distance program against a number of measures, including program enrollment data, progress completion reports, curriculum and schedule reports and financial summaries of each EPD-owned program to identify areas for improvement. This assessment will be led by the Distance Degree Director (Wayne Pferdehirt) and summarized yearly for the EPD Executive Committee.

In addition to these internal reviews, EPD is also familiar with the five-year program review process for new programs and every ten years thereafter, and will ensure that the review of the capstone certificate is completed as needed after implementation.
9. Admissions

EPD Student Services Director Gary Henderson will lead the admissions process in coordination with Jane Schimmel from the Division of Continuing Studies who leads University Special Student admissions. The capstone certificate admissions requirements include a B.S. in Engineering from an ABET-accredited institution, or an undergraduate major in a similar field with equivalent evidence of a suitable background. Potential students that do not meet these criteria will have the option of taking prerequisite courses (ECE 355: Electromechanical Energy Conversion, ECE 377: Fundamentals of Electric and Electromechanical Power Conversion, and ME 340: Introduction to Dynamic Systems) at a distance prior to applying to the capstone in order to properly prepare them for post-baccalaureate engineering study. There will be an undergraduate GPA requirement of at least 3.0 overall or on last 60 credits for admission to the capstone program. The program will not require Graduate Record Exam (GRE) scores for application. Students who did not earn their B.S. degree in an English-speaking program will be required to verify proficiency scores on the TOEFL test of at least 92 (internet) or 580 (paper). Admission to the program will be allowed in Fall, Spring or Summer semesters, since the three courses in the capstone are not sequential.

Admission to the Capstone program will not guarantee admission to one of the existing online engineering M.S. graduate programs. Prospective students will be advised of this fact and the requirements they will need to meet if they plan to eventually apply to one of the related online M.S. degree programs.

10. Marketing and enrollment

As stated previously, a significant market exists for continuing professional education in this technical area, as evidenced by the number of students currently supported by EPD in both credit and non-credit courses, including up to 20 existing special students per term. Enrollment of 10-15 new students is expected in fall, with additional students expected in spring and summer. Capacity of up to 20 students per course exists.

Marketing of the capstone certificate will include the following:

- Web: Press release, DCS portal, EPD website, WEMPEC website
- Conferences and Trade Shows: e.g., SWE, Rockwell Automation Fair, IEEE Conferences
- Organizations: WEMPEC newsletter, report, and annual meeting, direct marketing to UW-ECE and ME alumni, IEEE mailings from EPD, SWE
- Outreach to current non-credit students: Presentations and flyers at each non-credit power conversion and control EPD course

11. Progress and certificate completion

Student Services Director Gary Henderson, with support from EPD’s Program Associate Julie Wiest will be responsible for Satisfactory Progress monitoring of all Capstone students and notify the
degree audit department in the Registrar’s Office that students have completed the certificate at the close of each term to ensure the Capstone Certificate is posted on the student’s transcript. EPD will also issue a physical certificate of completion. Student progress will be tracked in EPD’s in-house student database tracking system (ET). The system is currently used to track potential student inquiries and rosters distance engineering courses, and is integrated into current student monitoring processes.

12. Advising and exceptions

Academic Director Professor Thomas Jahns will act as Faculty Advisor for the capstone program. Since the capstone is a defined curriculum as a general rule there will be no exceptions to the three-course sequence allowed. Any exceptions would require the approval of Prof. Thomas Jahns or Prof. Bob Lorenz.

Additional support is available in the following areas:

**Technical Support:** Provided by an EPD team, students have 7-day a week access to technical support for course access, materials, and other technical issues at ddtechsupport@epd.engr.wisc.edu.

**Student Services:** For general questions including help with registration, tuition payments, exam proctoring and records, students can access the EPD team at studentservices@epd.engr.wisc.edu.

**Graduate Admissions:** Students that have questions about future admission to a graduate program after completion of the capstone can discuss program options will the capstone Faculty Advisor. Students will also be directed to the graduate coordinators for specific information on individual programs (Daryl Haessig for the MS-EE program and Theresa Pillar-Groessbeck for the MS-ME program).

13. Financial Aid and Graduate Assistantships

No financial aid or graduate assistantships are available for University Special Students in a capstone program.

14. Fiscal Structures

EPD offers a unique model for new instructors and online course development designed to provide an exceptional level of support. Faculty will receive up to one month of funding from EPD for updating, recording, or changing courses in the curriculum, typically used for summer salary support. In addition to financial support, faculty will be provided with instructional design and production support for developing materials as needed. As an additional benefit, participating faculty will have unrestricted UW-related use of all online course materials, enabling their use for on-campus instruction.

When participating faculty’s classes are offered, revenue sharing follows the established CoE Revenue
Programs Distance sharing model (Figure 1). It assumes that one quarter (25%) of the tuition revenue generated by specials students enrolled in this program will be returned directly to the department and instructor teaching the course, to be distributed at their discretion through an accessible fund, translated to summer salary, or used for buy-out. Another 25% will be used to provide partnering faculty with funded teaching assistants and instructional support, and student services. A third 25% will be allocated to support the development of future distance learning initiatives. The remaining 25% will be used for marketing, administration, and online delivery infrastructure, as shown below.

This program will primarily use existing resources that are sustainably funded through current special student revenue recovery. However, since the administration of the capstone program will be streamlined through DCS and include a limited, defined curriculum of courses already developed for online delivery, expenses are expected to decrease. Therefore EPD fully anticipates this program will be self-sustaining in the first year of operation.
15. Ongoing Commitment

The Power Conversion and Control Capstone program is an essential, strategic addition to the College of Engineering’s portfolio of continuing professional development opportunities for working engineers in the growing field of power electronics, machines, drives and controls. The capstone program complements existing efforts, providing additional opportunities and easier access for students than ever before.

The College’s commitment to this field began with EPD’s strong non-credit course business in the 1970s, followed by the formation of the Wisconsin Electric Machines and Power Electronics Consortium in 1981 and the development of the off-campus MS-EE and MS-ME programs in 1985 that support over 70 students today. Dedicated resources to this area include the WEMPEC Director and Administrator, five EPD Program Directors, supporting Program Associates and technical staff, and a committed base of faculty, instructors and student coordinators in the ECE and ME Departments. As an integrated piece of our continuing education portfolio, this capstone has the support of a well-established team, existing resources for online outreach, and marketing effort to make it successful. We commit to:

- Maintenance of our existing websites with accurate and timely information on capstone course offerings,
- Readily available student and faculty support services, and
- Timely governance and assessment strategies that will ensure UW College of Engineering’s continued leadership and ranking in the online graduate education space.

Supporting Documentation

1. Letter of Support from the EPD Curriculum Committee
2. Letter of Support from Department of Electrical Engineering
3. Letter of Support from Department of Mechanical Engineering
4. Letter of Support from Professor Thomas Jahns
5. Letter of Support from Professor Neil Duffie
6. Capstone Certificate Implementation Form
To: Phil O’Leary, Department Chair  
From: Wayne P. Pferdehirt, Chair EPD Curriculum Committee  
Date: December 11, 2014  
Subject: Endorsement of Capstone Certificate in Power Conversion and Control  
CC: EPD Curriculum Committee members and file

Please accept this endorsement by the Curriculum Committee of the Department of Engineering Professional Development for the creation of a new online Capstone Certificate in Power Conversion and Control. The Committee reviewed this proposal on December 5, 2014, and voted unanimously in support of this initiative. We believe this Capstone Certificate will provide engineers with strong foundational skills in this area that we know are in demand in the power electronics, drives and controls industries.

This program will complement our existing degree programs, as the target students are practicing engineers looking for higher education credentials, but are either unable to come to campus or are unsure of their ability to fit a graduate master degree into their schedule.
19 November, 2014

Phil O’Leary
Professor and Chair
Department of Engineering Professional Development
University of Wisconsin - Madison
432 N. Lake Street
Madison, WI 53706

Dear Phil,

Please accept the support from the Department of Electrical and Computer Engineering for the development of a new online Capstone Certificate in Power Conversion and Control. We believe this initiative will provide engineers with strong foundational skills in this area that we know are in demand in the power electronics, drives and controls industries.

This program will complement our existing degree programs, as the target students are practicing engineers looking for higher education credentials, but are either unable to come to campus or are unsure of their ability to fit a graduate masters degree into their schedule.

We appreciate EPD’s development of this program, as it also helps provide our participating faculty with connections to industry and revenue support for their efforts. The cooperation between our two departments in this important and timely effort will deliver strategic advantages to the College, UW, and most importantly to our students, their employers, and society at large.

We look forward to moving ahead with you in this endeavor.

Sincerely,

[Signature]

John Booske
Professor and Chair
26 November 2014

Phil O’Leary
Professor and Chair
Department of Engineering Professional Development
University of Wisconsin - Madison
432 N. Lake Street
Madison, WI 53706

Dear Phil,

The Department of Mechanical Engineering supports the development of a new online Capstone Certificate in Power Conversion and Control. We believe this initiative will provide engineers with strong foundational skills in this area; we know that these skills are in demand in the power electronics, drives and controls industries. As the target students are practicing engineers looking for higher education credentials who are either unable to come to campus or are unsure of their ability to fit a graduate (MS) degree into their schedule, this program will serve as a complement to our existing degree programs.

We appreciate EPD’s development of this program because it provides our participating faculty with connections to industry as well as revenue support for their efforts. The cooperation between our two departments in this important and timely effort will deliver strategic advantages to the College, UW, and most importantly to our students, their employers, and society at large.

We look forward to moving ahead with you in this endeavor.

Sincerely,

Jaal Ghandhi
Professor and Chair

Design  ·  Analyze  ·  Build
November 16, 2014

Prof. Philip O’Leary, Chair
Department of Engineering Professional Development
432 N. Lake Street
Madison, WI 53706

Re: Proposed Capstone Certificate in Power Conversion and Control

Dear Prof. O’Leary:

I am writing to express my strong support for the new Capstone Certificate in Power Conversion and Control that has been proposed. I would be pleased to participate in this program with my course, ECE 411: Introduction to Electric Drive Systems, and to assist the new program’s Admissions Committee.

This capstone program will be attractive to many of our WEMPEC sponsors since it will provide a respected UW-Madison credential for working professional engineers that are seeking specialized instruction in the fields of power electronics, machines, drives, and converter controls that they did not receive during their undergraduate studies.

As additional benefits, it will help interested students with insufficient academic backgrounds to prepare for our online M.S. degree program in Electrical Engineering (Power) program by introducing foundational concepts and courses. It will also give prospective students a chance to prove their capabilities before they are admitted into the M.S. program.

I appreciate EPD’s partnership in supporting the faculty in the program with instructional design, delivery support, and funded teaching assistants, in addition to faculty compensation. The cooperation between our two departments in this capstone initiative will expand the reach of this program and deliver strategic advantages to the College, UW, and, most importantly, to our students and their employers.

Sincerely,

Thomas M. Jahn

Dr. Thomas M. Jahn
Grainger Professor of Power Electronics and Electric Machines

Wisconsin Electric Machines and Power Electronics Consortium
November 9, 2014

Professor Philip O’Leary, Chair
Department of Engineering Professional Development
432 N. Lake Street
Madison, WI 53706

Dear Professor O’Leary,

I welcome this opportunity to express my full support for a new Capstone Certificate in Power Conversion and Control, and I will be pleased to participate in this program with my course, ME 446: Automatic Controls.

I am convinced that this capstone program will be attractive to our industry partners because it provides a respected UW-Madison credential for working professional engineers who are in need of specialized instruction that they did not receive at the undergraduate level in the fields of power electronics, machines, drives and controls.

It also will prepare students with insufficient backgrounds for our online M.S. in Mechanical Engineering (Controls) program by introducing fundamental concepts and giving these students a chance to prove their capabilities.

Our partnership with the Department of Engineering Professional Development is greatly appreciated because it supports faculty in the program with instructional design, delivery support and funded teaching assistants, in addition to faculty compensation. The cooperation between our departments will expand the reach of this program, and will deliver strategic advantages to the College, UW-Madison, and most importantly to our students and their employers.

Sincerely,

[Signature]

Neil A. Duffie
Professor

Power Conversion and Control Capstone Certificate, Page 16 of 19
Implementation Form – Capstone Certificates

This form must accompany a capstone certificate proposal. An updated form should be submitted when changes to the certificate are made. It is used by administrative offices to better assist departments and programs with implementation. Questions in this form reflect guidelines in the Full Guidelines for For-Credit Certificates, http://apir.wisc.edu/certificates.htm.

Document Date: 12/1/14  
Name of Capstone Certificate: Power Conversion and Control  
Faculty Program Director: Thomas Jahns  
Primary Faculty/Staff Contact: Marty Gustafson  
Home Department/Academic Unit (Name/UDDS): Engineering Professional Development  
Approval Date: 12/5/2014  
School/College: Engineering  
Approval Date: 12/10/14  
GFEC Approval Date:  
UAPC Approval Date:  
Implementation Term (typically the fall term after UAPC approval): Fall 2015  
Year that first program review is scheduled (usually 5 years after implementation): Fall 2020

Information to be completed by RO and APIR:  
Plan Code (assigned by the Registrar’s Office):  
CIP Code (assigned by Academic Planning and Institutional Research):  
Primary Divisional Disciplinary Assignment (assigned by APIR for analysis purposes only):

Curriculum (check one):  
___X___ Included in detail in the proposal  
___X___ A list of required and elective courses and any other program requirements is attached  

ECE 411: Introduction to Electric Drive Systems  
ECE 412: Power Electronics Circuits  
ME 446: Automatic Controls  

Credit total required (9-12 credits): 9  
Projections for annual enrollment: 15

Specify overlap provisions – name degree/major, minor or certificate programs that a student may have previously earned that disqualify them from being admitted to the capstone certificate program.

M.S. Electrical Engineering (Power)  
M.S. Mechanical Engineering (Controls)
<table>
<thead>
<tr>
<th>Please answer the following:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirm that the capstone certificate is open to only non-degree seeking University Special students who hold a bachelor’s degree.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Confirm that all credits are required to be earned in residence at UW-Madison.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Will there be limits on enrollment?</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>If Yes, please explain: GPA of 3.0 is recommended</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm that all core/required courses are approved through the school/college curriculum committee.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Confirm that courses in curriculum are offered on a regular basis and have space for students in this program.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Confirm that required courses in the curriculum are numbered 300 or above.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Confirm that courses taken as Pass/Fail or Audit are not included in the curriculum.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Are courses taken Credit/No Credit allowed?</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>If yes, specify limits:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm that special topics courses are only used if all instances count for the certificate.</td>
<td>X</td>
<td></td>
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<tr>
<td>Confirm that, at a minimum, C grades must be earned on all course work attempted for the capstone certificate program. (Only graduate-level work from the capstone that is earned with a grade of B or better is eligible for subsequent application to a UW-Madison graduate degree program.)</td>
<td></td>
<td>X</td>
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<tr>
<td>If other requirements, please specify:</td>
<td></td>
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<tr>
<td>Will exceptions to the course core requirements be allowed?</td>
<td>X</td>
<td></td>
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<tr>
<td>If yes, specify limits and process:</td>
<td></td>
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<tr>
<td>Confirm that the program/department has a process in place to monitor student progress and to notify the Registrar’s Office when students complete the certificate requirements.</td>
<td>X</td>
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<tr>
<td>Assessment plan – confirm that the proposal includes a plan that describes how the program faculty will regularly evaluate student learning.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Confirm that the program/department understands that international students who must request a UW-Madison-issued I-20 (for the F-1 student visa needed for legal study in the US) will only be eligible to participate in the program if it is offered full-time and if the program has been approved by the US government to receive such international students. If the program is offered entirely online or the international student is here legally on another visa (such as the JS, H, etc.) and an I-20 from UW-Madison is not needed, then this provision does not apply.</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
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<tr>
<td>Will this capstone certificate be implemented as a program revenue program?</td>
<td>X</td>
<td></td>
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<tr>
<td>Has a budget been developed with the Division of Continuing Studies and the sponsoring school/college dean’s office?</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Who is the appropriate school/college contact for questions?</td>
<td>Marty Gustafson</td>
<td></td>
</tr>
</tbody>
</table>