University of Wisconsin-Madison
Graduate Faculty Executive Committee
1:30 p.m. – 3:30 p.m., Room 52 Bascom Hall
May 11, 2018

A G E N D A

(PDF of All Materials)

Introduction

1:30 Automatic Consent approval of the minutes from April 13, 2018 GFEC20180511.01

Approvals

1:35 Request to suspend Named Option “Controls” in MS Mechanical Engineering effective Fall 2018 (Greg Nellis, Jake Blanchard, Lee DeBaillie) GFEC20180511.02

1:40 Request to approve a new Named Option “Accelerated Program” in MS Mechanical Engineering effective Fall 2019 (Jaal Ghandhi, Jake Blanchard, Lee DeBaillie) GFEC20180511.03

1:55 Request to Approve the Graduate/Professional Certificate in Business Analytics from the School of Business effective Fall 2018 (Don Hausch) GFEC20180511.04

2:05 Request to approve new Named Option “Quantum Computing” in Physics MS effective Fall 2019 (Sridhara Dasu, Mark Saffman) GFEC20180511.05

2:20 Request to Extend Graduate Faculty Status for Former Professor from the Department of Communication Sciences and Disorders in the College of Letters and Science (Parmesh Ramanathan) GFEC20180511.06

Program Review and Updates

2:25 Mathematics MA/PhD/Doctoral Minor Program Review Update (Parmesh Ramanathan) GFEC20180511.07

2:30 Five-Year Supplemental Review of the Capstone Certificate in Post-Graduate Psychiatric Nursing (Parmesh Ramanathan)

2:35 Agricultural and Applied Economics Ten-Year Review (Mike Graham) GFEC20180511.09

3:00 Ten-Year Review of the Capstone Certificate in Actuarial Science (Kristin Eschenfelder) GFEC20180511.10

2017–2018 Meeting Schedule
June 8
1:30 p.m. – 3:30 p.m.
52 Bascom Hall
Members Present: Caroline Alexander, Alex Dressler, Michael Graham, Yu Hen Hu, William Karpus, Steffen Lempp, Lisa Martin, Christa Olson, Nicole Perna, John Pfotenhauer, Parmesh Ramanathan, Tracy Schroepfer, Steph Tai, Monica Turner, Earlise Ward

Members Absent: Lara Collier, Kristin Eschenfelder, Leslie Smith III

Guests: Monika Chavez, Max Collier, Greg Downey, Julie Karpelenia, Sarah Kuba, Pete Miller, Art Rainwater, Patrick Sheehan, Steve Smith

Staff: Judy Bauman, Meghan Chua, Alissa Ewer, Kelly Haslam, Michelle Holland, Peter Kinsley, LaRuth McAfee, Emily Reynolds

Dean William Karpus called the meeting to order.

The minutes of March 9, 2018, were approved as a matter of automatic consent.

Information Item

1. Dean Karpus introduced Office of Human Resources Director of Talent Acquisition and Retention Patrick Sheehan and Office of the Vice Chancellor for Research and Graduate Education (OVCRGE) Assistant Vice Chancellor Julie Karpelenia, who presented an update from the Graduate Assistant Policies & Procedures (GAPP) Workgroup. The goal of the committee was to transition the language from the former Teaching Assistant Association (TAA) contract into easily-accessible policies for current students.

Approval:

2. Dean Karpus introduced Professor Pete Miller and Clinical Professor Art Rainwater, who presented a request from the Department of Educational Leadership and Policy Analysis to approve a new non-pooled named option “Wisconsin Idea Principal Preparation Program” in the MS in Educational Leadership and Policy Analysis. The new named option would be offered in part at a distance in Green Bay to meet the needs of the area for producing K-12 education leaders. The program is 14 months in length and would allow graduates to pursue certification as principals or superintendents. This program would utilize a $500,000 allocation in the state budget to support a forgivable loan program for school leaders.

Motion: Moved and seconded to approve the named option “Wisconsin Idea Principal Preparation Program” in the MS in Educational Leadership and Policy Analysis. The motion passed unanimously.

Program Reviews and Updates:
3. Associate Dean Parmesh Ramanathan presented an update from the graduate programs in Agronomy following their institutional program review. The department will require an agronomy seminar for all of their students as part of efforts to build community and forge an identity for Agronomy students.

4. Professor Monika Chavez introduced the Institutional (10-Year) Review of the MA/PhD in Interdisciplinary Theatre Studies. The GFEC representative assigned to the review, Patricia Rosenmeyer, is no longer at UW–Madison; Chavez served as the chair of the program review committee. Chavez noted strengths of the program include historically high placement rates into the academic community and a good national reputation. Chavez also noted that challenges to the program include the struggle of being an interdisciplinary program, that they continue to work through their separation from Theatre & Drama with a new governance structure and students who perceive a loss of identity and confusion about their place in the Department of English. Chavez discussed review committee recommendations, including improving the sense of community among ITS graduate students, expanding their online presence and connecting with alumni to support recruiting and career placement, creating a program-specific subject listing for classes (currently the committee notes that course offerings are unpredictable), and making sure the new governance structure is clear and organized while involving a greater number of faculty. Dean Karpus noted the program has low numbers of domestic targeted minority students enrolled, long time-to-degree, and low completion rates; the GFEC would like a response from the program on these issues. The GFEC commends the program on its strengths and recommends it develop actionable plans to address the review committee’s concerns.

Motion: Moved and seconded to accept the Institutional (10-Year) Review of the MA/PhD in Interdisciplinary Theatre Studies. The motion passed unanimously.

5. GFEC Member Christa Olson presented the Institutional (10-Year) Review of the MS/Doctoral Minor in Life Sciences Communication. Olson noted this is a strong program with significant faculty investment; other strengths include engaged and well-supported students with a strong sense of community, good career outcomes and placements into PhD programs, loyal and involved alumni, and nationally-renowned faculty. Olson also discussed the review committee recommendations, which included better recruitment of targeted domestic minority students and better grievance and disciplinary procedures documented in the graduate program handbook. The program is also greatly interested in retaining their doctoral minor to help bench scientists on campus develop communications skills, and they believe they have several students in the pipeline. The GFEC commends the program on its strengths and recommends it engage in efforts to address the review committee’s concerns.

Motion: Moved and seconded to accept the Institutional (10-Year) Review of the MS/Doctoral Minor in Life Sciences Communication. The motion passed unanimously.

Discussion:

6. Graduate School Policy and Planning Analyst Peter Kinsley presented on the Graduate School Explorer, a new data tool. Among other uses, GFEC members should refer to the Graduate School Explorer during program review committee work.
Policy Approval:

7. Associate Dean Parmesh Ramanathan introduced a request to approve a new policy on Annual Assessment and Feedback (AAF) on Progress Towards Degree. By the end of the Spring 2019 semester, all doctoral programs must develop a procedure for providing (approximately) annual assessment and feedback to doctoral students on their progress towards degree. Effective in the Fall 2019 semester, all programs must implement their procedures. The GFEC expressed a need to reexamine the actual problem this policy would be trying to address and come up with solutions that meet those challenges. The GFEC also wanted to spend more time revising the policy language.

Motion: Moved and seconded to lay on the table consideration of the Graduate School policy on Annual Assessment and Feedback (AAF). The motion passed unanimously.

Adjournment

Motion: Moved and seconded to adjourn. The motion passed unanimously.
Date: April 25, 2018

To: Graduate Faculty Executive Committee

From: James P. Blanchard, Executive Associate Dean

RE: Suspension of Admission to the online Master of Science: Mechanical Engineering in Controls

At its April 25, 2018 meeting, the College of Engineering Academic Planning Council unanimously recommended approval of the proposal to suspend admission to the Master of Science: Mechanical Engineering in Controls program.

Due to the impending retirement of the key faculty member involved with this program, the decision was made to request suspension of admission to allow for re-evaluation of this offering. Additional information can be found in the memo below.

On behalf of the College of Engineering, I endorse and accept the recommendation to suspend admission to the Master of Science: Mechanical Engineering in Controls program.
MEMORANDUM

To: William J. Karpus
    Dean, Graduate School

    Sarah C. Mangelsdorf
    Provost

From: Jaal B. Ghandhi
    Grainger Professor of Sustainable Energy and Chair, Mechanical Engineering

Re: Suspension of Admission to the online Master of Science: Mechanical Engineering in Controls

Request:
The Department of Mechanical Engineering is proposing that admission to its online Master of Science: Mechanical Engineering in Controls program be suspended effective immediately.

Precipitating Factors / Background:
The Master of Science: Mechanical Engineering in Controls program was largely built around the research of Mechanical Engineering Professor Robert Lorenz. Professor Lorenz teaches three out of seven courses required for this degree. In addition, Professor Lorenz has historically advised the majority of the students conducting independent study projects that are part of the program’s research requirement. Unfortunately, Professor Lorenz has received a serious health diagnosis that has accelerated his plans for retirement.

Because there are no existing faculty members within the Department in a position to take over the courses historically taught by Professor Lorenz at the present time, I am requesting an immediate suspension of admissions to allow more time to assess if and how the program should be re-structured or whether to discontinue the program. A final decision on the program will be made by the Spring of 2021.

Communication plan:
The Department of Engineering Professional Development provides support to the Department of Mechanical Engineering for delivery of this online graduate degree program. I have been in close communication with the EPD chair, Professor Douglas Reindl, regarding our intention to suspend admission to this degree program. Professor Reindl concurs with the plan to suspend and he has communicated this direction to all EPD staff involved with this program. Once approved, a wider communication of this program’s status will be shared with the Division of Continuing Studies (for removal of the program from the AYC website and other marketing
Teach-out plan:
At present, there are six graduate students enrolled in the online Master of Science: Mechanical Engineering in Controls program. One candidate is on track to graduate at the conclusion of the Sp’18 semester, three are on track to graduate by the conclusion of the Sp’19 semester, and two have longer times to degree. All five students scheduled to graduate after Sp’18 still need to complete the research component for their programs. Professor Lorenz has agreed to advise three of the remaining five students as those three are on track to complete their degrees by Sp’19, the last semester Professor Lorenz intends to teach. These three students only require one or more elective courses beyond the research component. Professor Bülent Sarlioglu (EPD and ECE) has agreed to serve as faculty research advisors for the remaining two students who started the controls program in Fall ‘16 and ‘17. These two students still need to take the following required courses: ME746 and ME577. Professor Lorenz has agreed to teach ME746 in the Sp’19 semester. ME577 is offered during the summer every other year and its next planned offering is during the Su’19 semester. Plans are not yet complete for teaching ME577 in Su’19; however, we anticipate this course will be covered. A backup plan is to utilize either ECE504 or ECE 512 as a substitute for ME577. ECE504 is taught every other summer and will be taught Su’18 and is expected to be taught in Summer 2020.

Courses that will continue to be taught and available to the current students in the Controls program include the following controls-related courses ME446, ME447, and ME747. In addition the online Power1 program courses ECE355, ECE411, ECE412, ECE427, ECE711, ECE712, ECE713, ECE714, ME/ECE 739 will also be available. Additional elective courses can be taken from EPD701, EPD702, EPD703, EPD704, EPD706, EPD708, EPD712, EPD713, EPD781, EPD782, EPD783, EPD784, and EPD785 provide other elective course options for the existing Controls program students intending complete the requirements for their degree.

In addition to the six students currently active in the program, there are an additional two students that are stopped-out of the program. One student has completed nine credits but has not been enrolled since the Fa’17 semester and the second student has completed three credits and has not been enrolled since the Fa’16 semester. There are no plans to readmit either of these students; however, students that have stopped-out will be given the option to apply to the Master of Science Electrical Engineering Power program (a related online degree program) and, if accepted, their accumulated credits from the Controls degree program applied toward that program.

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1 A number of courses in the Controls program are also shared with the online Master of Science: Electrical Engineering Power program.
Admissions Status:
The program will not admit new students in Fa’18. Current and incomplete program received a communication on 3/23/18 from EPD Chair Douglas Reindl explaining that program admissions had been suspended.

As of 3/23/18 there were 4 complete applications in Applicant Review. Those applicants received a letter from Professor Reindl explaining that admissions to the online program had been suspended. EPD has already initiated application fee refunds for applicants who only have applied to the online program. (Most applicants applied to multiple Mechanical Engineering programs and those applications are still being processed.) The EPD Graduate Programs Coordinator is fielding questions and communications from applicants. Ten in-process applicants with incomplete online Controls applications received a similar email from Professor Reindl on 3/23/18.

Approvals:
The Executive Committee of the Department of Mechanical Engineering unanimously approved this proposal at its meeting on April 19, 2018. The Academic Planning Council of the College of Engineering approved the proposal at its meeting on April 25, 2018. (A memo from Executive Associate Dean Jake Blanchard is attached to this memo.)
April 25, 2018

William Karpus, Dean
Graduate School
University of Wisconsin - Madison

Dear Bill,

At the April 25, 2018 meeting of the College of Engineering Academic Planning Council, the following new named option program was recommended for approval:

- Master of Science: Mechanical Engineering, Named Option: Mechanical Engineering Accelerated Program.

The proposal is attached.

We are excited about the prospects for increasing our enrollment of terminal Masters students, given the accelerated nature of the proposed option. In addition, we have created this with efficiency in mind and we envision common administrative and advising staff support to help us achieve these goals. We are now requesting approval from the Graduate Faculty Executive Committee.

Thank you for considering this request.

Sincerely,

James P. Blanchard
Executive Associate Dean
jake.blanchard@wisc.edu
A named option is a formally documented sub-major within an academic major program. Named options serve as a convenient way to distinguish a distinct curriculum or delivery format within a major.
A named option is NOT a new degree or major. Authorization by the Board of Regents to deliver an academic program is at the degree/major level.

This form is to be used in concert with the Policy Guidelines for Named Options within Academic Majors. Complete the form and save as a Microsoft Word document.

1. **Overview**
   1.1. Named Option: Accelerated Program
   1.2. Academic Major: Mechanical Engineering
   1.3. Home Department: Mechanical Engineering
   1.4. School/college: College of Engineering
   1.5. Partner department(s)/units/schools/colleges: none
   1.6. Chair of the Major (name, title, email): Jaal Ghandhi, Chair, jaal.ghandhi@wisc.edu
   1.7. Primary faculty or staff contact for the proposal (name, title, email): Greg Nellis, Associate Chair, gfnellis@engr.wisc.edu
   1.8. Primary school/college dean’s office contact (name, title, email): James Blanchard, Executive Associate Dean, jake.blanchard@wisc.edu
   1.9. Briefly describe the type and purpose of the named option.

   This will be a non-pooled tuition revenue program for a Master of Science in Mechanical Engineering. The purpose of the named option is to provide a Master of Science program that is course-based with no research component, accelerated (12 month duration) and terminal. This option will provide further training for students wishing to pursue a high-level job in industry. This approach will allow us to recruit from a broader audience that is interested in a terminal M.S. degree that can be accomplished in a single year, thus increasing our graduate enrollment.

   What prints on the diploma: Master of Science-Mechanical Engineering
   What prints on the transcript: Master of Science-Mechanical Engineering, Named Option: Accelerated Program
   Major: Mechanical Engineering, Option: Accelerated Program

   1.10. Date form completed: 3/28/2018

2. **Approval Implementation and Expectations for Review**
   2.1. School/College Approval Date: 4/25/2018
   2.2. GFEC Approval Date (graduate level named options only): Click here to enter a date.
   2.3. UAPC Approval Date: Click here to enter a date.
2.4. Expected first term of student enrollment (typically the first fall after UAPC approval): Fall 2019
2.5. Year of three year progress report to GFEC (3 years after first student enrollment; graduate level named options only): Fall 2022
2.6. Year of first program review (5 years after first student enrollment): 2024-2025
2.7. Are all academic programs in the home department up to date for program review? Yes.

The Self Study for the Certificate in Thermal Energy Systems has been completed this spring and will be presented to the CoE APC in their May meeting. At that point the review will be sent to the Graduate School.

The Campus Assessment Plan and Implementation Form of the Certificate in Manufacturing Engineering was submitted to the graduate school. This certificate is not due for a self study or review until 2020.

3. Background/Rationale
3.1. How does the named option relate to the major and to other named options in the major, if relevant?

Currently the ME program has two tracks in its pooled MS program - the thesis option and course option. In fact, both options require some research, either a thesis project (thesis option) or an independent study project (course option). Further, both options require that international students identify a research adviser in order to be admitted. As part of our preparation for the implementation of this proposal, ME will eliminate the course option and have a single, research option for its pooled MS program (this will be a pooled named option). Currently, both pooled MS options largely consist of students who are supported either by RA or TA appointments at a level that provides tuition remission. Therefore, none of these students would be eligible for the proposed named option program. Because both pooled M.S. degrees require research, in neither case do students typically finish in less than 3 semesters (typically 2 years) and students are focused on obtaining a research-based job or continue for the Ph.D. The proposed Accelerated Mechanical Engineering Degree program is complementary to our research-focused programs but allows students who do not want to carry out independent research to obtain an M.S. degree within a single year. The program requires no independent or other research and is entirely course based. Other named options in Mechanical Engineering are much more directed to a specific application area (Automotive Engineering and Modeling and Simulation).

3.2. What is the purpose of the named option? How does the named option contribute to the mission of the sponsoring unit?

The purpose of the named option is to provide a Master of Science – Mechanical Engineering program that is course-based and accelerated. Students can complete this program in a single calendar year. Students who received their undergraduate degree from the University of Wisconsin ME Dept. can complete this program in 9 months (two semesters).

ME undergraduates must take a wide breadth of classes. This option allows these students to focus at an advanced level on a particular area of Mechanical Engineering in order to gain the underlying knowledge to carry out advanced technical work in areas such as mechanics, controls, thermal system modeling, manufacturing, biomechanics, product development, design, optimization, or other work. The named option contributes significantly to the mission of the Department of Mechanical Engineering by increasing the number of Master-level graduate students and enhancing the reputation of the Department and the College.
internationally.

3.3. What is the evidence that there is a student demand for the named option?

Currently the department receives many more MS applicants than are admitted or who attend. International students who are not able to secure an adviser are not admitted at all. Such students are excellent candidates for the proposed accelerated, course-based MS degree. Finally, many of our ME MS students are our own (UW) students who are able to carry over 6 credits but are not interested in research. These students complete an independent study project only because it is required and complete the MS degree as quickly as possible. Such students can transfer 6 credits from their undergraduate degree and would therefore be able to finish this accelerated degree in 24 credits or two semesters (9 months). Students in this accelerated program will understand that it is self-funded.

4. Curriculum

4.1. Delivery modality:

Face-to-face

4.2. Provide a complete list of named option requirements.

Students are required to complete 30 credits of formal course work including M E 903 Graduate Seminar (0 credits). A minimum of 15 of these credits must be formal course credits in ME taken at the UW-Madison.

_Program requirements should provide content that leads to the completion of major learning goals._

See section 5 Assessment.

4.3. Attach a full curriculum including all required and elective courses.

4.4. For undergraduate named options, attach a four year roadmap.

_Named options for undergraduate majors will have requirements totaling 120 credits and students should be able to complete the degree/major within four academic years._

4.5. For graduate named options, attach a [chart outlining minimum degree requirements and elements for satisfactory progress](#).

_Master’s level programs will include at least 30 credits of requirements. Doctoral level programs will include at least 51 credits of requirements._

**Checklist for Verification of Curricular Policy Requirements**

You will have an opportunity to provide explanation and rationale for any Curricular Policy Requirements that have not been affirmed in the text box that follows the check list, below.

☐ Courses are offered on a regular basis.

☐ Courses have enrollment capacity for students in the named option.

☒ All courses required for the named option are fully approved. (ME459 is in the approval process)

☒ Units must maintain Named Option requirements so that they are up-to-date; all curriculum changes must be approved through the appropriate school/college academic planning council (APC) or curriculum committee. The school/college APC or curriculum committee will notify the Office of the Registrar and the Graduate School (graduate level named options only) about approved curricular changes to the named option. Typically, any changes in requirements will be effective no sooner than the fall semester after approval.

*Provide explanation and rationale for any Curricular Policy Requirements that have not been affirmed.

Provide explanation for Curricular Policy Requirements that have not been affirmed here.
5. **Assessment**

5.1. attach a program assessment plan when submitting this proposal. Assessment plans for a named option should be integrated with the assessment plan for the major. See the Basic Assessment Plan for instruction and accompanying template. The Basic Assessment Plan and Template are minimum expectations for this information. Programs that have developed plans that exceed what is specified in the basic plan may provide that information.

5.2. provide a summary of the program assessment plan, including learning goals for the major and any additional learning goals that are specific for the named option, key methods and assessment approaches, and how assessment information will be reviewed and acted on.

Student Learning Goals:
1. Demonstrate a strong understanding of mathematical, scientific, and engineering principles in the field
2. Demonstrate an ability to formulate, analyze, and independently solve advanced engineering problems
3. Apply the relevant scientific and technological advancements, techniques, and engineering tools to address these problems
4. Recognize and apply principles of ethical and professional conduct.

Method for assessing learning:
The student's faculty advisor will review the student’s course work performance and complete the College’s learning goals checklist before the end of the final semester.

Plan for review of the assessment information:
The graduate committee will review the assessment data, and report to the department faculty at a faculty meeting once a year and report the program assessment results – both the data summary and any recommendations -- to the Dean's Office. The Dean's Office will present all program assessment reports to the College Academic Planning Council (APC).

The assessment summary should highlight how the named option is included in the overall assessment plan for the major. The named option must adhere to all learning goals for the major and may also have additional learning goals that are specific for the named option.

6. **Overlap and Related Programs**

6.1. specify any other degree/majors, named options, or certificates that may not be earned in combination with this named option.

Students will not be permitted to earn more than one named option offered by the College of Engineering. Students will also not be allowed to earn this named option and the related MS degree (MS ME) with no option. Students in this named option cannot enroll concurrently in any other degree or certificate program at UW-Madison.

Overlap restrictions must be managed at the program level as part of the advising process. When proposing a named option that has the same name as an existing degree/major certificate or doctoral minor at the same level, the program will be required to put in place processes to ensure that students do not enroll in both programs with the same name. If the program faculty choose to limit any other overlap with other degree/majors, named options, or certificates a list must be specified in the proposal and the program faculty/staff will be responsible for monitoring and enforcing overlap limits.
7. **Admissions & Enrollment**

7.1. For graduate programs proposing a named option with admissions requirements that are distinct from the major with no named option, explain the admissions criteria and process.

The same graduate admissions committee will be used for both the named option and the major. The named option will admit students that meet the minimum English language proficiency requirements of the graduate school, but will not allow lower scores. Essentially, no students will be admitted that may require ESL courses, as the accelerated course load does not offer room for additional courses.

7.2. What is the projected annual enrollment in the named option?

Initially 20, with the expectation that the option enrollment will grow to at most 40 students per year.

7.3. What is the maximum enrollment (using existing instructional and student resources)? 40

7.4. What are the contingency plans for supporting enrollments higher than the stated maximum enrollment?

The bottleneck is related to availability of summer courses that will allow the 12 month completion of the program. Large enrollment would require that additional summer courses be offered ONLY in the summer so as to ensure that these courses become the final two courses in a student’s program. There are several, generally useful ME graduate courses that could be offered in the summer in the areas of manufacturing, mechanics, and simulation. We are confident we can alleviate this type of resource-access pressure by using program revenue funds to increase the FTE support for summer instruction.

**Checklist for Verification of Admission Policy Requirements for Undergraduate Named Options**

*You will have an opportunity to provide explanation and rationale for any Admission Policy Requirements that have not been affirmed in the text box that follows the checklist.*

☐ Named option admission requirements are consistent with admission requirements for the major with no named option, if the major has any admission requirements beyond admission to the University. Admission limits should be related to interest or aptitude for the content and not based solely on a high GPA cutoff

☐ The named option will be declared and canceled using the e-Declaration process in the student information system.

☐ Undergraduates will not be advised to declare or remain enrolled in a named option if it will extend their time to graduation. Undergraduate students are to be discouraged from earning more than one named option that represents an area of curricular emphasis within the major.

*Provide explanation and rationale for any Admission Policy Requirements that have not been affirmed in the above checklist.*

Type explanations for Admission Policy Requirements not affirmed here.

8. **Advising**

8.1. List name(s) of major and named option advisor(s) with title and departmental affiliation(s).
Major: Mechanical Engineering
Named option advisor(s): Greg Nellis and one additional faculty member to be named.

8.2. Describe how there will be sufficient advising and academic support for all students in the major (both the existing major’s students and the new students that will be served by the named option).

We anticipate having one additional ME faculty member to work with the Associate Chair in order to provide advising. Additionally, student have access to revenue-supported graduate service coordinators and a college-level named option program director. College-level career advising services are also available.

8.3. ☒ Confirm that major and named option advisor(s) have been consulted and reviewed this proposal.

9. Governance & Faculty
9.1. ☒ The named option must be governed by the same department or academic unit that oversees the major. Any sub-committee governing the named option must report to the faculty governance committee for the major.
9.1.1. If a sub-committee governs the named option, describe procedures including how faculty are identified and provisions for transitions in the committee.

9.2. List core faculty and staff with title and departmental affiliation(s).
Core Advising Faculty: Greg Nellis and one additional faculty adviser to be named.
Core Teaching Faculty: All of the Department of Mechanical Engineering provides graduate level class options that will be used for this program.

10. Fiscal Structure and Ongoing Commitment
10.1. Provide an overview of plans for funding the named option including but not limited to program administration, instructional/curricular delivery, technology needs, and program assessment.

All expenses will be covered by program revenue. Since the program is delivered in a face-to-face format, the costs related to delivery and technology are minimal and difficult to quantify. There may be some additional TA or grader support required by larger than normal enrollments. Assessment will be addressed within Mechanical Engineering using the same processes to be employed for existing majors. These processes are being developed now.

10.2. How will the named option impact staffing needs beyond the immediate program? How are those needs being met?

The College of Engineering has added two full time staff members to assist with admissions and administration of named options programs. These positions are shared across a number of named options, so the costs to each individual program will be minimal. Additional TAs and graders may be required to assist with individual courses. If enrollment is high then new courses will be created and those costs will be borne by that program. This will require sufficient enrollment to justify the costs and will not occur within the first year. As staffing needs grow to support enrollment, tuition revenue will be used to fund that staff expansion.
10.3. For named options supported using non-pooled tuition, provide a fiscal annual summary including planned enrollment, estimated paid tuition, instructional costs, and estimated excess tuition available for reinvestment in keeping with the separate guidelines for non-pooled programs.

See attached.

10.4. For graduate programs supported using pooled tuition, provide a plan for how new graduate students will be funded.

N/A

Required attachments
☒ Cover letter from the Dean of the school/college that will be the home of the named option
When a proposal for a new named option is forwarded for approval, it will have a cover letter to the provost from the supporting dean.
☐ Supporting letters/memos
Proposals must be accompanied by letters or memos submitted by the chair or director of other academic units that have overlapping interest. These notes may comment on shared resources, competition for students or other ways in which the programs will interact surrounding the named option. This will include departments/schools/colleges, share a student audience, represent a closely related area of study, have overlapping faculty, or have program names that are similar.
☒ Full curriculum including all required and elective courses
☐ For undergraduate named options, attach a four year roadmap.
☒ For graduate named options, attach a chart outlining minimum degree requirements and elements for satisfactory progress.
☒ Assessment plan

Named options supported using non-pooled tuition must attach:
☒ Core Criteria Checklist
☒ Additional Requirements Checklist
See the current Non-pooled Program Requirements Process document posted at https://kb.wisc.edu/vesta/page.php?id=59300
Proposed Curriculum

Accelerated MS in Mechanical Engineering

Credits required for graduation: 30

Progress towards graduation sequence: (Fall → Spring → Summer progression)
Fall Semester: 12 Credits
Spring Semester: 12 Credits
Summer Session: 6 Credits

Required courses:
- ME 903 Graduate Seminar (both semesters)

Other notes on courses:
- No thesis credits (ME 790 or ME 890) are allowed.
- Up to 3 credits of independent study credits are allowed but not required.
- Students must take at least 15 credits of Mechanical Engineering courses at the 400 or higher level.
- 15 of the 30 credit hours must be at the graduate level; 9 of these must be in ME.
- Sample curriculum tracks are listed below, but students can take courses from combinations of paths in order to create a custom degree that is well-aligned with their professional goals.
- All courses must be taken within the College of Engineering until Memorandums of Agreement are in place with relevant external schools and colleges. The College of Engineering has developed an internal system for sharing tuition revenue between departments.

Sample course of study:
Fall semester:
- ME 439 Introduction to Robotics
- ME 549 Product Design
- ME 561 Intermediate Thermodynamics
- ME 573 Computational Fluid Dynamics

Spring semester:
- ME 447 Computer Control of Machines
- ME 461 Thermal System Modeling
- ME 564 Heat Transfer
- ME 601 Applied Math for Mechanical Engineers

Summer semester:
- ME 418 Engineering Design with Polymers
- ME 420 Polymer Composites Processing

Curriculum Tracks

- **Energy**
  - ME 460 Applied Thermal/Structural FE Analysis
  - ME 461 Thermal System Modeling
  - ME 469 Internal Combustion Engines
  - ME 561 Intermediate Thermodynamics
  - ME 563 Intermediate Fluid Dynamics
ME 564  Intermediate Heat Transfer
ME 566  Cryogenics
ME 567  Solar Energy
ME 569  Applied Combustion
ME 572  Intermediate Gas Dynamics
ME 601  Gas Turbine Technology
ME 601  Applied Math for Mechanical Engineers
ME 759  HPC for Engineering Applications
ME 761  Advanced Thermodynamics
ME 764  Advanced Conduction
ME 769  Combustion Processes
ME 770  Advanced Experimental Instrumentation
ME 774  Kinetics of Combustion Systems
ME 775  Turbulent Heat and Momentum Transport
ME 777  Vacuum Technology

Mechanics, Biomechanics and Controls
ME 415  Biomechanics of Human Movement
ME 439  Introduction to Robotics
ME 440  Intermediate Vibrations
ME 444  Design Problems in Elasticity
ME 445  Mechatronics
ME 446  Automatic Controls
ME 447  Computer Control of Machines
ME 448  Mechanical Systems Analysis
ME 451  Kinematics & Dynamics of M/C
ME 459  Computing Concepts for Applications in Engineering
ME 460  Applied Thermal/Structural FE Analysis
ME 577  Automatic Controls Lab
ME 601  Physics-based Modeling for Computer Control
ME 601  Applied Math for Mechanical Engineers
ME 603  Finite Elements for Biomechanics
ME 605  Introduction to Finite Elements
ME 615  Tissue Mechanics
ME 705  Advanced Topics in Finite Elements
ME 739  Advanced Robotics
ME 746  Dynamics of Controlled Systems
ME 753  Friction, Wear and Lubrication
ME 759  HPC for Engineering Applications

Manufacturing & Computer Aided Design
ME 417  Introduction to Polymer Processing
ME 418  Engineering Design with Polymers
ME 419  Fundamentals of Injection Molding
ME 420  Polymer Composites Processing
ME 424  Statistical Experimental Design
ME 429  Metal Cutting
ME 437  Material Selection
ME 449  Redesign & Prototype Fabrication
ME 459  Computing Concepts for Applications in Engineering
ME 460  Applied Thermal/Structural FE Analysis
<table>
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<tr>
<th>Course Code</th>
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<tr>
<td>ME 514</td>
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<td>ME 535</td>
<td>Computer Aided Geometric Design</td>
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<td>ME 548</td>
<td>Intro. To Engineering Optimization</td>
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<td>ME 549</td>
<td>Product Design</td>
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<tr>
<td>ME 558</td>
<td>Introduction to Computational Geometry</td>
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<td>ME 601</td>
<td>Digital Design &amp; Fabrication</td>
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<td>ME 601</td>
<td>Applied Math for Mechanical Engineers</td>
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<td>ME 605</td>
<td>Introduction to Finite Elements</td>
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<td>ME 705</td>
<td>Advanced Topics in Finite Elements</td>
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<td>ME 748</td>
<td>Optimum Design of Mechanical Systems</td>
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<td>ME 751</td>
<td>Matrix Methods in Design</td>
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<td>ME 758</td>
<td>Solid Modeling/Model-based Engineering</td>
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<td>ME 759</td>
<td>HPC for Engineering Applications</td>
</tr>
<tr>
<td>ME 964</td>
<td>Computational Geometry of Materials</td>
</tr>
</tbody>
</table>
# Minimum Degree Requirements & Satisfactory Progress

*Schools/Colleges, Departments and Programs may set more rigorous expectations and requirements than the Graduate School*

- If describing multiple degree plans at the same level (M.A. and M.S.) or multiple named options and tracks within a plan, indicate requirements for all plan variations.
- Please note that “Example” in the chart provides an example of policy – but is not necessarily reflective of Graduate School’s policy. For the actual Graduate School policies, you may consult the Graduate School Degree Requirements chart at [http://grad.wisc.edu/catalog/degreq_criteria.htm](http://grad.wisc.edu/catalog/degreq_criteria.htm) to ensure program compliance with Graduate School degree requirements.
- If the program policy aligns with Graduate School degree requirements, please reiterate the policy in your program’s degree requirement chart – do not simply provide “Follow Graduate School Policy”.
- Programs are responsible for monitoring more restrictive requirements.

<table>
<thead>
<tr>
<th>Master’s Degrees:</th>
<th>Accelerated MS in Mechanical Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Graduate Degree Credit Requirement</td>
<td>30 credits</td>
</tr>
<tr>
<td>Minimum Graduate Residence Credit Requirement</td>
<td>18 credits</td>
</tr>
<tr>
<td>Minimum Graduate Coursework (50%) Requirement</td>
<td>At least 50% of credits applied toward the graduate degree credit requirement must be completed in graduate-level coursework.</td>
</tr>
</tbody>
</table>

### Prior Coursework Requirements: Graduate Work from Other Institutions

With program approval, students are allowed to count up to 12 credits of graduate coursework from other institutions. Approved credits will be allowed to count toward the minimum graduate degree credit requirement and the minimum graduate coursework requirement, but will not count toward the minimum graduate residence credit requirement. Coursework earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.

### Prior Coursework Requirements: UW–Madison Undergraduate

With program approval, no more than 7 credits of coursework numbered 300 or higher from a UW–Madison undergraduate degree are allowed to count only toward the minimum graduate degree credit requirement. Coursework earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.

### Prior Coursework Requirement: UW–Madison University Special

With program approval, students are allowed to count up to 15 credits of coursework numbered 300 or above taken as a UW–Madison special student toward the Minimum Graduate Residence Credit Requirement, and the Minimum Graduate Degree Credit Requirement; those courses numbered 500 or above may be applied toward the Minimum Graduate Coursework (50%) Requirement. Coursework earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.

<table>
<thead>
<tr>
<th>Credits per Term Allowed</th>
<th>15 credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program-Specific Courses Required</td>
<td>No</td>
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</tbody>
</table>

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*Acceleration MS in Mechanical Engineering*
<table>
<thead>
<tr>
<th>Overall Graduate GPA Requirement</th>
<th>3.00</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other Grade Requirements</strong></td>
<td>The Graduate School requires an average grade of B or better in all coursework (300 or above, not including research credits) taken as a graduate student unless conditions for probationary status require higher grades. Grades of Incomplete are considered to be unsatisfactory if they are not removed during the next enrolled semester.</td>
</tr>
<tr>
<td><strong>Probation Policy</strong></td>
<td>The Graduate School regularly reviews the record of any student who earned grades of BC, C, D, F, or Incomplete in a graduate course (300 or above), or grade of U in research credits. This review could result in academic probation with a hold on future enrollment or in being suspended from the Graduate School.</td>
</tr>
<tr>
<td><strong>Advisor / Committee</strong></td>
<td>Every graduate student is required to have an advisor. To ensure that students are making satisfactory progress toward a degree, the Graduate School expects them to meet with their advisor on a regular basis.</td>
</tr>
<tr>
<td><strong>Assessments and Examinations</strong></td>
<td>No formal examination required.</td>
</tr>
<tr>
<td><strong>Time Constraints</strong></td>
<td>Master’s degree students who have been absent for five or more consecutive years lose all credits that they have earned before their absence. Individual programs may count the coursework students completed prior to their absence for meeting program requirements; that coursework may not count toward Graduate School credit requirements.</td>
</tr>
<tr>
<td><strong>Language Requirements</strong></td>
<td>Contact the program for information on any language requirements.</td>
</tr>
</tbody>
</table>
Accelerated MS in Mechanical Engineering

**Identifying Information**
School/College: College of Engineering  
Graduate Degree/Major Program Name: Accelerated MS in Mechanical Engineering  
Graduate Degree Level (M.S., M.A., Ph.D., DMA, etc.): M.S.  
Faculty Director Contact/Title: Greg Nellis, Associate Chair for Mechanical Engineering  
Primary Contact Information: gfnellis@engr.wisc.edu

**Student Learning Goals**
Assessment of graduate-level learning goals is one of the many ways in which our campus ensures the integrity of its degrees and the quality of the student experience. List the graduate student learning goals for this academic degree program below.

1. Demonstrate a strong understanding of mathematical, scientific, and engineering principles in the field
2. Demonstrate an ability to formulate, analyze, and independently solve advanced engineering problems
3. Apply the relevant scientific and technological advancements, techniques, and engineering tools to address these problems
4. Recognize and apply principles of ethical and professional conduct.

**Plan for Assessing Each Student Learning Goal**
For each of the degree major/program student learning goals, indicate how the program plans to assess whether or not students are meeting the expectation, as well as when each learning goal will be assessed. Keep in mind that each academic degree program is expected to engage in at least one assessment activity per year and assessment activities, in total, must include one direct assessment method. While programs do not need to assess each learning goal every year, all learning goals must be assessed within a period of three years.

<table>
<thead>
<tr>
<th>Assessment Planning (How)</th>
<th>Method for assessing learning</th>
</tr>
</thead>
</table>
| Method for assessing learning (at least one direct method required) | 1. All graduating MS students will fill in a survey form to answer a series of questions pertaining to all of the learning goals. For example, whether the student feels comfortable in problem solving related to Mechanical Engineering. Data from these self-reported measures will be compiled bi-annually and applied to the annual reports on specific learning goals (this is an indirect measure).  
2. The list of courses taken by students will be checked in order to ensure that the courses directly map to learning goal 1. The grades obtained by students in these courses will be analyzed. |
3. Feedback from ME course instructors will be requested to evaluate the student learning goals for the ME courses in which students are enrolled.
4. The course list taken by the students in the program will be reviewed every three years by the Graduate Curriculum Committee. Specifically, the course content will be checked to see if the corresponding learning goals are sufficiently addressed by the content. If not, allowable courses for the program may be modified.

| Timetable for assessment activity (at least one activity each year; all goals reviewed in a 3-year cycle) | All learning goals will be evaluated annually. |

*For examples of direct and indirect methods of assessment, see: [http://provost.wisc.edu/assessment/doing-assessment.htm](http://provost.wisc.edu/assessment/doing-assessment.htm). You may elect to copy and paste this table multiple times if your program has more than five learning goals.*

Also provide answers to the following questions as part of your assessment plan.

1. **Who is responsible for assessment?** (identify an individual or team who will coordinate the implementation of the plan on an annual basis):
   The associate chair will provide assessment updates, keep track of the assessment timeline, and remind by email the faculty to collect the students’ course work performance for assessment. The associate chair will compile and perform initial analysis on all student learning assessment data. Assessment data will be forwarded to the faculty involved in the program for further evaluation.

2. **What is the plan for review of the assessment information?** (typically during an annual meeting of the program faculty and staff; note that at this meeting the program may want to review enrollment information, course progression, degree completion, and other structural features of the student experience in addition to the evidence about student learning):
   The associate chair in collaboration with the graduate committee will lead a discussion and review of the assessment data. The program assessment results – both the data summary and any recommendations – will be presented at the Department Meeting.

3. **What is the plan for production of an annual summary report?** (the annual summary report includes the materials that form the basis of discussion at the annual meeting of the program faculty and staff, along with any recommendations made after considering the student learning assessment information presented):
   After reviewing the assessment summary and comments from the Department Meeting the Graduate Committee will decide which (if any) items are actionable and provide a report of those plans, along with the initial assessment summary to the Dean’s Office.

4. **How will recommendations be implemented?** (explain the general process by which recommendations will be implemented):
Any actionable items will be discussed during Graduate Committee Meetings held in the spring semester. If approved at that time, any curricular/programmatic changes will be implemented in the fall semester.

**Graduate Degree Program Curriculum Mapping Worksheet (Where)**

This worksheet, or similar document, **must be included** with the submission of the program’s assessment plan.

- **Learning Goals** – Enter the academic degree program learning goals identified in the assessment plan on the top row of the following chart. (If the learning goals have been submitted to the Office of the Provost, a pre-populated template is available; contact regina.lowery@wisc.edu) Feel free to add columns if the academic degree/major program has more than five learning goals.

- **Degree/Major Program Courses/Experiences** – List all degree requirements (in some cases co-curricular experiences may also be included). Feel free to add rows as needed.

- **Indicate with a check (X) where the course or learning experience contributes to each of the learning goals. Courses may contribute to multiple learning goals.**

<table>
<thead>
<tr>
<th>Course # (all ME)</th>
<th>Course Name</th>
<th>Learning Goal #1</th>
<th>Learning Goal #2</th>
<th>Learning Goal #3</th>
<th>Learning Goal #4</th>
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<td>Biomechanics of Human Movement</td>
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<td>Intr. To Polymer Processing</td>
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<td>418</td>
<td>Engineering Design with Polymers</td>
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<td>419</td>
<td>Fundamentals of Injection Molding</td>
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<td>x</td>
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<td>Polymer Composites Processing</td>
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<td>424</td>
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<td>Material Selection</td>
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<td>Intro to Robotics</td>
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<td>Intermediate Vibrations</td>
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<td>Design Problems in Elasticity</td>
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<td>Automatic Controls</td>
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<td>Computer Control of Machines</td>
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<td>Mechanical Systems Analysis</td>
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<td>Redesign &amp; Prototype Fabrication</td>
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<td>Kinematics and Dynamics of M/C</td>
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<td>X2</td>
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<td>Computing Concepts for Applications in Engineering</td>
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<td>Physics-based modeling for computer control</td>
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<td>Introduction to Finite Elements</td>
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<tr>
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<td>Tissue Mechanics</td>
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<td>Design of orthopedic implants</td>
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<td>Image Based Biomechanics</td>
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<tr>
<td>608</td>
<td>Plates, Shells and Pressure</td>
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<td>Advanced Composite Materials</td>
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<td>Molding &amp; Simulation of Polymer Proc.</td>
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<td>x</td>
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<td>Advanced Robotics</td>
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<td>x</td>
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<tr>
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<td>Dynamics of Controlled Systems</td>
<td>x</td>
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<tr>
<td>708</td>
<td>Optimum Design of Mechanical</td>
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<td>x</td>
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<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>605</td>
<td>Friction, Wear Lubrication</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>605</td>
<td>Solid Modeling/Model-based engineering</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>605</td>
<td>HPC for Engineering Applications</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>706</td>
<td>Advanced Thermodynamics</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>605</td>
<td>Advanced Conduction</td>
<td>x</td>
<td>x</td>
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<td>x</td>
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<tr>
<td>605</td>
<td>Combustion Processes</td>
<td>x</td>
<td>x</td>
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<tr>
<td>706</td>
<td>Advanced Experimental Instrumentation</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>706</td>
<td>Kinetics of Combustion Systems</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>706</td>
<td>Turbulent Heat &amp; Momentum Transport</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>707</td>
<td>Vacuum Technology</td>
<td>x</td>
<td>x</td>
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</table>

*Add additional rows as needed to capture all requirements.*

Minimally, all of the courses/experiences required to complete the major degree program should be listed. Optionally, elective courses may be included in addition to the required courses.
BUDGET

Accelerated MS in Mechanical Engineering

In the first year, this program will likely enroll up to around 20 students. Hence, impact on existing programs will be minimal and the instructional costs will be minimal.

As the program grows, we anticipate needing to add additional staff and faculty time to develop/offer summer courses as well teaching assistants and graders for larger enrollments. If at any time this program requires the addition of course sections to handle the load, instructional staff for the new sections will be supported by revenue from this program. However, this is not anticipated, and the extra load will be handled by the addition of TAs as needed.

Beyond the instructional needs, the College of Engineering will provide centralized staff support for administration, student services, and program marketing and evaluation.

Draft Budget

Average future enrollment: 40 students

Estimated annual tuition: $20,000 per student

Annual revenue: $800,000

Annual University Assessment: $80,000

Annual College of Engineering Assessment: $160,000

Annual Instructional Costs:

  2 TA FTE for 12 months: $28,000

  Supplies: $50,000

Estimated excess tuition available for reinvestment: $482,000
APPENDIX A. CORE CRITERIA CHECKLIST
FOR ACADEMIC PROGRAMS WITH NON-POOLED TUITION

1. New and Additional Student Enrollments to Support Program Costs
   ☒ The program must bring in NEW and ADDITIONAL students. Overall enrollment in all other school/college programs must not be eroded. The program cannot compete with or draw students away from existing programs that support the central tuition pool.
   ☒ Faculty/staff must plan for sufficient enrollments to have enough tuition to cover instructional, direct student support costs, and any other fixed or required costs. Experience shows that enrollments of at least 30 students are necessary to have enough tuition to meet direct program costs.
   ☒ School/college Budget Officers must be involved in planning and must approve plans and budgets for these programs before the program is submitted to the school/college APC for academic approval.

2. Designed for Non-Traditional Students
   ☒ Has an applied, practice-oriented curriculum, or integrates practice with theory
   ☒ Is offered in a modality that allows non-traditional audiences to attend (evening, weekend, online, intensive, or some combination)
   ☒ Has demonstrated a workforce demand for the program graduates
   ☒ Has defined learning goals that are oriented to market considerations
   ☒ Has a clearly defined curriculum that is “self-contained”, meaning that program students are confined only to courses from the approved, prescribed curriculum
   ☒ Has a clearly defined (often lockstep) curriculum with few options or electives that follows a predictable timeline for offerings and completion

3. Distinctly Identifiable Program (Code) With Governance Approval
   ☒ The program must be distinctly identifiable in the student record system, either as a degree/major or as an option of a degree/major, or as a Capstone certificate.
   ☒ The program must develop a proposal for the academic approval process, during which it must demonstrate that the school/college Dean and Budget Officer are aware and supportive of the program being run on a non-pooled tuition model.
APPENDIX B. ADDITIONAL REQUIREMENTS CHECKLIST
FOR ACADEMIC PROGRAMS WITH NON-POOLED TUITION

Use this checklist in conjunction with the Core Criteria Checklist

If core criteria are met, the program must adhere to the additional requirements below.
Note: Not all new programs are suited for the non-pooled program requirements. New programs that seek to take advantage of a wide range of course and curricular/program offerings on campus and are not market-oriented should be developed under traditional (101) pooled tuition funding models.

1. Fiscal Requirements:
   ◦ School/college budget officer has approved the budget and fiscal plan.
   ◦ School/college dean and budget officer are committed to assuming fiscal responsibility for costs not covered by non-pooled tuition to the program. The school/college will back up the budget with a commitment to cover any costs not met from tuition from other sources.
   ◦ The program structure fits within standard academic administrative structures and allocates expenses of the program so that the program does not create additional burdens on traditional/101 program resources or student services such as advising, ESL, Registrar’s Office, Bursar’s Office, Graduate School and other support services.
   ◦ Programs have two options for tuition. One option is to charge standard graduate tuition according to the UW-Madison tuition schedule. This includes standard rates for WI resident, MN, and non-resident students and any compulsory fees that apply. Or, for fully online programs, they have the option of charging all students one of tuition tiers (Appendix D). Although not currently allowed, it is potentially possible in the future the tiered tuition may be available to face-to-face programs.
   ◦ Because students who have graduate assistantships receive tuition waivers, some non-pooled tuition graduate degree programs choose to prohibit students from accepting a graduate assistantship (RA/TA/PA). If a program allows their students to take graduate assistantships they it must forgo the tuition revenue. To ensure full receipt of non-pooled tuition and to counter challenges from students, the program must adhere to the following:
     ◦ The program faculty/staff must disclose this program policy to students in the recommendation of admission letter, program website, program handbook, and program orientation.
     ◦ Please see Appendix E for links and Appendix F for a sample of a specific non-pooled program template for a recommendation of admission letter and a general template for a program handbook. The program faculty/staff must provide details on this and any other program policies the program handbook in at least the following areas: satisfactory progress (good standing) requirements, any ways to return to good standing, and a program grievance process if done does not already exist.

2. Requirements for International Students:
 Programs may not admit students who need ESL services without building sufficient ESL support into their fiscal model, and having an explicit MOU with the ESL provider about funding to support the ESL services.

 Graduate degree/major programs must use Graduate School standards for English Proficiency. Capstone certificates should be designed so that admission requirements ensure that ESL support is not needed.

 If the program is NOT completely online and admits international students, the program is responsible for honoring federal visa regulations related but not limited to: length of stay requirements for visa requests, online course restrictions for visa holders, and waiting for federal program approval (up to a year) if the program represents a new degree type or capstone certificate previously not offered at UW-Madison.

3. Requirements for Program/Course Enrollment:

 Programs may only enroll in one program at a time; enrollment in a second major, named option, certificate program, or courses beyond the prescribed program curriculum is not permitted. Non-compliance with this requirement will jeopardize the receipt of tuition for a non-pooled program. Regular audits will be conducted to ensure these requirements are met.

 To ensure full receipt of non-pooled program tuition and to counter challenges from students who want to be dually enrolled, the program must adhere to the following:

 The program must provide information to students about prohibitions on concurrent program enrollment and out-of-program course enrollment. Programs must note this in recruiting materials, in recommendations of admission, on the program website, program handbook, and program orientation.

 Please see Appendix E for links and Appendix F for language for a specific non-pooled program template for a recommendation of admission letter and a general template for a program handbook. The program faculty/staff must provide details on this and any other program policies in the program handbook in at least following areas: satisfactory progress (good standing) requirements, ways to return to good standing, and a program grievance process if one does not already exist.

 The program communicates to students each semester prior to course enrollment the expectation that students can enroll only in program courses and not in courses outside the approved, prescribed curriculum.

 For students who enroll in the non-pooled program and then decide they want to pursue traditional/101 programs that allow dual enrollment, the program must help the student transfer to a different program(s) that allow such activity.
Date: April 24, 2018

To: Sarah C. Mangelsdorf, Provost and Vice Chancellor for Academic Affairs

From: Barry Gerhart, Interim Albert O. Nicholas Dean, Wisconsin School of Business (WSB)

RE: Request for Approval of WSB Graduate Certificate in Business Analytics

Attached please find a file in support of the Wisconsin School of Business (WSB) request for the Graduate Faculty Executive Committee to consider a proposal for a graduate certificate in business analytics. The file includes the proposal (which has been approved by WSB Masters Curriculum Committee, the WSB APC, and the WSB faculty) and letters of support or no objection from the Department of Statistics, the Information School, and the L&S APC.

We hope that our proposal can be considered at the May 11 GFEC meeting.

If the GFEC decision is positive, one issue as the proposal heads to the UAPC is approval of GEN BUS 704, a foundation course for the certificate. We expect WSB faculty approval of this course at our May 7, 2018 faculty meeting, and University Curriculum Committee approval of the course in early fall.

Please contact Senior Associate Dean Ella Mae Matsumura with any questions about the proposal. Thank you.

Copies:

Ella Mae Matsumura, WSB
Jocelyn Milner, APIR
Sarah Kuba, APIR
Emily Reynolds, Graduate School
INSTRUCTIONS FOR PROPOSING GRADUATE/PROFESSIONAL CERTIFICATES and USE OF PROPOSAL FORM

A Graduate/professional certificate program is a designated set of for-credit courses focused upon a specific topic or theme that give students the opportunity to pursue a subject of interest in a formalized way that is documented on the transcript.

PLANNING THE GRADUATE/PROFESSIONAL CERTIFICATE

- Planning starts with idea development among the program faculty and staff.
- Begin to fill out the Graduate/professional Certificate Proposal Form.
- When your ideas are starting to take shape, consult with your school/college dean’s office. If you aren’t sure who to talk to in your school/college dean’s office or if you have questions and want to discuss your plans, contact the director of Academic Planning and Institutional Research.
- When you have a full draft of a completed Graduate/professional Certificate Proposal Form, and ideally before school/college approval, send the proposal to the director of Academic Planning and Institutional Research and the Graduate School Assistant Dean for Academic Planning and Assessment for a check-in and proposal review. This will help make sure that the certificate meets all components of the UAPC guidelines and will identify any implementation questions.

APPROVAL STEPS FOR GRADUATE/PROFESSIONAL CERTIFICATES

1. The program faculty who are sponsoring the Graduate/professional certificate program (most often the faculty or executive committee in a department) formally approve the certificate proposal.
2. The school/college that houses the certificate considers the certificate for approval, usually at the school/college Academic Planning Council.
3. After school/college approval, the dean forwards the proposal to the provost and the dean of the Graduate School with a copy to the director of Academic Planning and Institutional Research and the Graduate School Assistant Dean for Academic Planning and Assessment.
4. The Graduate Faculty Executive Committee considers the certificate for approval.
5. The provost will seek a recommendation for approval from the University Academic Planning Council.

FOR INFORMATION AND FORMS: [http://apir.wisc.edu/certificates.htm](http://apir.wisc.edu/certificates.htm)

At this URL you will find links to the following information:

- Detailed instructions and the Graduate/professional Certificate Proposal Form
- Graduate/professional Certificate Guidelines, which is the policy framework for the proposal form (adopted April 2013)
- Certificate Knowledge Base - The KB houses certificate forms and frequently asked questions.

QUESTIONS: Sarah Kuba, Academic Planner, APIR ([sarah.kuba@wisc.edu](mailto:sarah.kuba@wisc.edu))
Jocelyn Milner, Director, Academic Planning and Institutional Research ([jocelyn.milner@wisc.edu](mailto:jocelyn.milner@wisc.edu))
PROPOSAL FORM
GRADUATE/PROFESSIONAL CERTIFICATE PROGRAMS

Graduate/professional certificates are intended for all degree-seeking graduate and professional students (technically, those in the following careers: GRAD, MED, LAW, VMED, PHARM and any additional degree-seeking post-bachelors careers that may be added). This form is to be used in concert with the Graduate/professional certificate guidelines. Complete the form and save as a Microsoft Word document.

1. Graduate/professional certificate name and academic home
   1.1. Graduate/professional certificate name: Business Analytics Certificate
   1.2. Home Department/Academic Unit (Name/UDDS): Wisconsin School of Business.  
       The home department/academic unit is responsible for the academic oversight, delivery, and administration of the certificate.
   1.3. Home School/College: Business, School of
   1.4. Additional Department(s)/Academic unit(s) information, if relevant: Participation by all departments in the Wisconsin School of Business (WSB)
   1.5. Faculty director of the Graduate/professional certificate program (name, title email): Don Hausch, WSB Bascom Professor, don.hausch@wisc.edu
   1.6. Primary Graduate/professional certificate program contact (name, title, email): Richard Crabb, WSB Lecturer, rcrabb@wisc.edu
   1.7. Primary school/college dean’s office contact (name, title, email): Barry Gerhart, WSB Acting Dean, barry.gerhart@wisc.edu and Sharon Kahn, Director of Academic Affairs, sharon.kahn@wisc.edu
   1.8. Date form completed: 3/28/2018

2. Approval, Implementation, and Review
   2.1. School/College Approval Date: Click here to enter a date.
   2.2. GFEC Approval Date: Click here to enter a date.
   2.3. UAPC Approval Date: Click here to enter a date.
   2.4. Expected first term of student enrollment (usually 2-3 terms after UAPC approval; typically the following Fall term): Fall 2018
   2.5. Year of three year progress report to GFEC (3 years after first student enrollment): 2021
   2.6. Year of first program review (5 years after first student enrollment): 2023

   2.7. Are all academic programs in the home academic unit are up to date for program review? Yes □
       If no, please provide an explanation:

   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):

3. Purpose, rationale, justification

Graduate/professional Certificate Proposal Form, 8-6-2015 Page 2 of 11
Describe the purpose, rationale, and justification for the Graduate/professional certificate:

3.1. What is the purpose of the Graduate/professional certificate program? How does it contribute to the mission of the sponsoring unit(s)? What gap in the program array is it intended to fill?

The purpose of the Graduate Business Analytics Certificate program is to achieve three objectives: Prepare students to (1) participate in and promote the progression from data and assumptions to information (descriptive methods), (2) to apply knowledge and understanding of how tools and methods can be used to support decision making (predictive methods), and (3) ultimately to document and communicate findings that lead to decisions and plans for implementation (prescriptive methods). Basic elements of the journey have long existed, but it is the integration of these objectives that defines business analytics here in the WSB.

The Certificate prepares students to use analytics for making decisions with a business mindset – seeking answers to questions in order to define the problem, gather necessary data, convert those data to decisions, arrive at and support a business-appropriate answer, and successfully communicate that answer in a form appropriate to the audience. By combining analytics with business knowledge, we prepare our students to function successfully in the data-rich business environment. Business students understand how business operates, how to communicate successfully with others in business, and are familiar with the concept of business goals and objectives. This business perspective is central to the design and differentiation of our certificate.

The curriculum is customized to our WSB Master’s degree framework. Since it relies on existing WSB courses, it can be delivered in a way that does not require additional resources.

There is strong demand for professionals with knowledge gained from an integrated program of statistics, data science, computer programming, information technology, and optimization, combined with business acumen and communication skills. We intend to offer a credential that clearly demonstrates to prospective students and company recruiters that the WSB provides Certificate holders with a competitive advantage in meeting the new challenges of the business work place.

The pressing need for this certificate is also evident viewing the following list of certificates and degrees involving analytics within our Big 10 peer group. Business school programs are marked with a "B".

Indiana
- Online Certificate in Data Science
- Business Analytics Certificate (B)
- Masters of Science in Data Science
- Master of Science in Information Systems (B)
- MBA - Major in Business Analytics (B)
- Online MS in Business Analytics (B)
- PhD Minor in Data Science

Purdue
- Certificate in Applied Statistics
- MBA, Specialization in Business Analytics (B)
- MS in Business Analytics & Information Management (B)
Iowa
   MS in Business Analytics (B)
   Graduate Certificate in Business Analytics (B)
   MBA & MS in Business Analytics Joint Degree (B)

Northwestern
   Certificate in Advanced Data Science
   Certificate in Analytics & Business Intelligence for IT Professionals
   Certificate in Business Analytics
   MS in Analytics
   MS in Information Systems with Concentration in Analytics and Business Intelligence
   Online MS in Data Science
   Certificate in Business Analytics for Decision Makers
   Program on Data Analytics (part of MBA) (B)

Illinois
   MS Accounting - Data Analytics in Accountancy (B)
   MS Computer Science in Data Science
   MS Statistics - Analytics Concentration

Maryland
   MS Business Marketing Analytics (B)
   Online MBA - Specialization in Information Systems & Business Analytics (B)
   PhD in Information Studies - Concentration in Big Data / Data Science

Michigan State University
   MS - Business Analytics (B)
   Master Certificate in Business Analytics (B)

Michigan
   Graduate Data Science Certificate

Minnesota
   MS in Business Analytics (B)
   MS in Data Science

Nebraska
   Business Analytics Graduate Certificate (B)

Rutgers
   Master of Business and Science Degree in Analytics - Discovery Informatics & Data Sciences
   MBA with Analytics and Information Management Concentration (B)
   Post MBA Certificate in Analytics and Information Management (B)

Ohio State University
   Specialized Master in Business Analytics (B)
Penn State
Graduate Certificate in Business Analytics (B)
Master of Professional Studies in Data Analytics
Master of Professional Studies in Data Analytics - Business Analytics Option

Wisconsin
MS Statistics - Data Science
Capstone Certificate in Data Analytics for Decision Making (first enrollment Spring 2019)

The only business schools in the Big 10 without a graduate program in Business Analytics are Michigan and Wisconsin, though Michigan has a program that is housed in a Data Science Institute that is affiliated with their business school.

In sum, business analytic skills are in high demand by employers. The Certificate will both motivate our students and provide them a coherent path to strengthen their analytical skills. It will help many of them in their internships during the program and with employment opportunities when they graduate. It will make WSB more attractive for students to attend, thereby growing demand for our graduate programs.

3.2. What is the evidence that there is a societal and student demand for the Graduate/professional certificate program?

Employer feedbacks tells us there is a strong demand for business analytics and numerous articles describe this demand. For example, two McKinsey Consulting studies (May 2011, December 2016) detail the demand and lack of supply for analytical talent. Collegerank.net ranks Business Analytics as one of the top 10 best careers for the future http://www.collegerank.net/best-careers-for-the-future/

As mentioned, all but Wisconsin and Michigan among the Big 10 schools have graduate programs in analytics in their business school, and more than 80 graduate schools nationwide have analytics programs, with that number growing annually. The WSB gap hurts in the competition for applicants. Anecdotally, potential MBA applicants routinely ask about our offerings in business analytics and compare us to competitors.

The iSchool at UW-Madison recently developed an Analytics program for managers, with their program scheduled to begin next year. In their development, they contracted for a marketing study on analytics and found strong demand and a strong willingness to pay for this education. The results of this study apply to the WSB as well.

The Risk and Insurance department is offering a course spring and summer 2018 at American Family Insurance to teach their employees analytic methods and tools. This was in response to high demand by employees.

The combination of studies, online articles, job openings, new and existing graduate programs, and company demand all point in one direction - the need for more students educated in Business Analytics.
4. Curriculum

4.1. Delivery modality:
☒ Face-to-face
☐ Distance

Distance-delivered programs are those certificate or degree programs in which 50% or more of the required courses may be taken as distance-delivered courses.

4.2. Provide a complete list of requirements.

- GEN BUS 704: *Data to Decisions* or GEN BUS 307 *Business Analytics II*
- One course in the area of “Analytics Tools & Methods”
- One course in the area of “Analytic Steps”
- One additional course from “Analytics Tools & Methods” or “Analytic Steps” that is outside the WSB department housing the student’s program.

GEN BUS 704 *Data to Decisions* is a two-credit course. (This course is currently offered as GB 765 until a course change approval process for GB 704, that is underway, is completed.) MBA students take GEN BUS 704 as part of their core requirements. GEN BUS 307 has a requisite of GEN BUS 306 *Business Analytics I* accounting for 6 credits of preparation in business analytics. Students in the WSB MAcc and MS programs matriculating from our BBA program will have taken GEN BUS 306 and 307. Both GEN BUS 704 and 307 offer a foundational hands-on experience with many commonly used analytic methodologies using modelling and optimization tools. Both focus on predictive and prescriptive analytics, and both are appropriate foundational requirements for this certificate.

Beyond the GEN BUS 704 or 307 requirement, the certificate requires nine credit hours in two knowledge areas that are defined below. Students must take at least three credits in each knowledge area and nine credits across both areas. Additionally, at least three credits of those nine elective credits must come from outside the WSB department housing the student’s major. (For our purposes here, Arts Administration students and Supply Chain Management students are considered to be in the MHR and OIM departments, respectively.) The two knowledge areas are:

1. Analytic Tools & Methods – providing substantial hands-on experience with software that allows sophisticated analytics, and learning one or more analytical methods, selecting an appropriate model, assessing model performance and limitations, and analyzing model output.

2. Analytic Steps – designing and managing a data-driven project, from start to finish. Analyzing output and making decisions utilizing analytics technology.

The current list of approved knowledge area courses is as follows:

**Analytic Tools & Methods (seven courses):**

- ACT SCI 654 – *Regression and Time Series for Actuaries*
- ACT SCI 655 – *Health Analytics*
- MARKETING 710 – *Marketing Research*
- MARKETING 815 – *Marketing Analytics*
- OTM 442 – *Database Management*
OTM 765 – Supply Chain Analytics  
RMI 660 – Risk Analytics and Behavioral Science  

Analytic Steps (four courses):
FINANCE 635 – Security Analysis  
MHR 765 – HR Metrics  
MARKETNG 727 – Enterprise Systems and Supply Chain Management  
OTM 752 – Project Management  

Program requirements should provide content that leads to the completion of Graduate/professional certificate learning goals. See section 8 Assessment.

4.3. Chart student progression through the curriculum.

<table>
<thead>
<tr>
<th>Semester students will take the course</th>
<th>Department</th>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Instructor</th>
<th>Semester &amp; year last taught</th>
<th>Grade</th>
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<tbody>
<tr>
<td>Please see above list for curriculum</td>
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Student progression is not lock-step other than beginning with the foundation course, either GEN BUS 704 or 307.

4.4. Total credits required: 11

Graduate/professional certificate programs are usually 9 to 12.

Checklist for Verification of Curricular Policy Requirements*
You will have an opportunity to provide explanation and rationale for any Curricular Policy Requirements that have not been affirmed in the text box that follows the check list, below.

☒ Courses for the Graduate/professional certificate are numbered 300 or higher.
☒ Courses are offered on a regular basis (as identified in student progression chart in section 4).
☒ Courses have enrollment capacity for students in the Graduate/professional certificate program.
☐ Courses in the proposed Graduate/professional certificate have been approved.
☐ Special topics courses are only used if all topics count for the certificate.
☒ At least half of the Graduate/professional certificate credits must be earned “in residence” (which includes on campus and distance-delivered courses) at UW-Madison while enrolled as a degree-seeking graduate/professional student.
☒ Students must earn a minimum 3.000 GPA on required certificate coursework. Completed courses listed within the certificate curriculum, whether or not they meet a specific requirement, are included in the calculation of the GPA.
☒ Courses in which a student elects the pass/fail option will not meet Graduate/professional certificate requirements.
☒ All Graduate/professional certificate program requirements must be met; waiving requirements is not permitted.
☒ Course substitutions to the certificate curriculum should be kept to a minimum; if substitutions are being made on a regular basis, the curriculum should be re-examined. When course substitutions are made, the substituted course should be formally added to the curriculum through governance for inclusion in the curriculum the following academic year.
☒ Substitutions are not permitted for any course unless the substitution would be provided for every student with the same substitution request.
☒ Units must maintain Graduate/professional certificate requirements so that they are up-to-date; all curriculum changes must be approved through the appropriate school/college academic planning council (APC) or curriculum committee. The school/college APC or curriculum committee will notify the Office of the Registrar and the Graduate School about approved curricular changes to the certificate. Typically, any changes in requirements will be effective no sooner than the fall semester after approval.

*Provide explanation and rationale for any Curricular Policy Requirements that have not been affirmed.

The required course GEN BUS 704 *Data to Decisions* will be offered as GEN BUS 765 until the approval process underway for the official version of the course is completed.
We have two topics courses listed (MHR 765, OTM 765). OTM 765 is being prepared for course approval as OTM 714. We intend for MHR 765 to follow.

5. **Student Services & Advising**

5.1. List the names of Graduate/professional certificate program advisor(s) with title and departmental affiliation(s).
   Don Hausch, Professor, Operations and Information Management
   Richard Crabb, Lecturer, Risk and Insurance

5.2. How will the resource load of the additional student services support and advising be met?
   The program advisors will provide advising and student support.
   Do the individuals or offices have the capacity to add student services support for the Graduate/professional certificate program? Does the program have the resources to support all aspects of advising and student support? Yes, although there is the possibility that the demand for this program may grow such that a dedicated director of the program may be necessary.

5.3. ☒ Confirm that program advisor(s) have been consulted and reviewed this proposal.

6. **Admission & Enrollment**

6.1. List any admission criteria for the Graduate/professional certificate beyond admission to a graduate or professional program and permission from the student’s home degree/major:
   Initial certificate enrollment will be limited to WSB graduate students.

6.2. Projected annual enrollment: 50 students

6.3. Maximum enrollment that can be supported with existing instructional and student services resources: 100 students

6.4. Describe plans for supporting enrollments that are much higher or much lower than the anticipated enrollment.
   Limiting enrollment to WSB graduate students caps enrollment on the high end, and we have the resources to accommodate those students in their chosen electives. Lower enrollment will also not be an issue as we are already offering our curriculum courses regularly.

6.5. ☒ The admission process requires students to gain consent from their degree/major program to participate in the Graduate/professional certificate program.
6.6. ☒ The certificate will be declared and canceled using the eDeclaration process in the student information system in consultation with a certificate program advisor.

7. Assessment

7.1. ☒ Attach an assessment plan when submitting this proposal. See the Basic Assessment Plan for Graduate/professional Certificates for instructions and the accompanying template. The Basic Assessment Plan and Template are minimum expectations for this information. Programs that have developed plans that exceed what is specified in the basic plan may provide that information.

7.2. Provide a summary of the Graduate/professional certificate’s assessment plan, including learning goals, key methods and assessment approaches, and how assessment information will be reviewed and acted on.

A student who has fulfilled the requirements of the Certificate will be able to do the following (our learning goals):

#1. Apply analytic tools to prepare, manage, and analyze data for projects (DESCRIPTIVE)
#2. Apply analytical tools and methods to both model business issues and appropriately assess and analyze model output (PREDICTIVE)
#3. Design and manage data analysis, interpret results, and communicate answers and/or recommendations to support decision making (PREScriptive)

Details of assessment are presented in the attached assessment plan, but involve performance on particular exam problems for learning goal #1 and course grades for learning goals #2 and #3. An additional requirement of each student is an INDIVIDUAL executive summary for a project from one of their certificate courses that: 1) describes the questions addressed; 2) explains the rationale for the design of their model; 3) explains the basis of their recommendations; and 4) describes their learnings through this process. This executive summary is separate and apart from the chosen certificate course and is submitted separately to the certificate administrator.

8. Related Programs

8.1. This Graduate/professional certificate will be offered as a: Graduate/professional certificate only. Students may not earn a Graduate/professional certificate and Capstone certificate of the same name. If the Graduate/professional certificate will be offered as a Graduate/professional certificate and a new Capstone certificate, a Capstone certificate proposal form must be completed.

8.2. List post-baccalaureate major/degrees, doctoral minors, and certificates that may not be earned in combination with this certificate. N/A

List majors, minors, and certificates that may not be earned in combination with this certificate here. N/A

Students may not earn a post-baccalaureate major/degree, doctoral minor or certificate with the same name/subject area. Students may not earn a certificate in which the certificate coursework overlaps 50% or more with another major, minor or certificate. The list should include such majors, minors and certificates. It is the responsibility of the department to monitor students and ensure they are not enrolled in overlapping certificates or major programs.

8.3 List majors that are anticipated to frequently be completed in combination with the proposed certificate. For each, describe how the certificate can be completed in combination with the major without increasing time to degree.
We anticipate that students from all ten MBA specializations, as well as MAcc and MS in Finance students will be interested in this certificate. There are sufficient elective choices in those academic programs to complete this certificate without affecting time to degree.

9. Governance & Faculty
9.1. The Graduate/professional certificate is governed by:
☒ Existing department and school/college governance committees
☐ New Graduate/professional certificate governance committees

▪ If the Graduate/professional certificate is governed by a new committee, define and outline governance structures and procedures for the certificate program.
Provide information on how program faculty are identified and provisions for transition in the faculty program director. Who will appoint the director and to whom will the director report?
There will be individuals with responsibility for the day-to-day oversight of the certificate, but they will abide by existing school governance.

List the core program faculty and staff with title and departmental affiliation(s) who are primarily involved and will participate in delivery and oversight of the Graduate/professional certificate.
- Steve Boeder (center director, Erdman Center for Operations and Technology Management)
- Kristin Branch (center director, A.C. Nielsen Center for Marketing Research)
- Richard Crabb (lecturer, Risk and Insurance)
- Jake Dean (center director, Grainger Center for Supply Chain Management)
- Don Hausch (professor, Operations and Information Management)
- Mike Judge (center director, Center for Brand and Product Management)
- James Morris (emeritus professor and chair, Operations and Information Management)
- Erwan Quintin (professor, Finance)
- Joan Schmit (professor and chair, Risk and Insurance)
- Enno Siemsen (professor, Operations and Information Management)

10. Progress & Certificate Completion
10.1. ☒ Using the student information system, the faculty program director and/or staff will be able to identify graduate and professional students enrolled in the Graduate/professional certificate program.

10.2. ☒ The faculty program director and/or staff will monitor students’ progress in the Graduate/professional certificate program.

10.3. ☒ The faculty program director and/or staff will notify the degree audit department in the Registrar’s Department (degreeaudit@em.wisc.edu) when a student has completed all of the requirements for the Graduate/professional certificate.
When the certificate is completed, the program faculty director or designee must notify the Registrar’s Office in order for the Graduate/professional certificate to be recorded on the official student record and for it to print to the transcript.

10.4. ☒ Certificates are not awarded retroactively to graduated students who completed all of the certificate before the certificate was approved.

11. Ongoing Commitment
11.1. What resources are allocated to the Graduate/professional certificate program?
Describe Graduate/professional certificate resources here. (1000 word limit) Existing set of strong and well-received courses, and program oversight for a fairly narrow set of students.

Is there a source of new funding? If the funding is from reallocation, what activities will be reduced as a result? Both the proposal from the program faculty and the school/college dean’s office cover memo should specify that the resource commitment is being made to the program.

Checklist for Verification of Ongoing Commitment*
You will have an opportunity to provide explanation and rationale for any Ongoing Commitments that have not been affirmed in the text box that follows the checklist.

☒ If the program requires new instructional resources, space, advising, additions to the Library collections, or other support, a supporting letter is attached to demonstrate that the appropriate unit can provide the resources.

☒ The Graduate/professional certificate program faculty are responsible for seeking appropriate governance approval for significantly altering the Graduate/professional certificate’s curriculum, suspending admissions or discontinuing the certificate program. Any changes in requirements will be effective no sooner than the fall semester after approval.

☒ The faculty/staff will make a three-year progress report to GFEC three years after first student enrollment.

☒ The faculty/staff will engage in program review five years after implementation and at least once every ten years after that.

☒ Low-enrollment certificate programs (fewer than 5 certificates in 5 years) will be subject to review. The faculty program director is responsible for the reporting of which students have completed certificate requirements to the school/college dean’s office and the Registrar’s Office. Certificates completed by students but not reported are not included in certificate counts, nor are they recorded on the student’s transcript.

☒ The program faculty/staff will ensure the program website and Graduate Catalog materials are current and consistent across all locations where information is provided. This includes providing information for official University publications such as the Graduate Catalog in the format requested by University Communications. In addition, more detailed, accurate, and formally approved information should be provided through a certificate program web site.

*Provide explanation and rationale for any Ongoing Commitments that have not been affirmed in the above checklist.

Required attachments
☒ Supporting letters/memos
Provide letters or memos from other academic units that will have overlapping interest. This will include departments/schools/colleges that provide courses for the certificate, share a student audience, represent a closely related area of study, have overlapping faculty, or have program names that are similar.

☒ Assessment plan
See the Basic Assessment Plan and Template for Graduate/professional Certificates for detail. The Basic Assessment Plan for Graduate/professional Certificates and the Template are posted at http://apir.wisc.edu/certificates.htm
1. Who is responsible for assessment? (Identify an individual or team who will coordinate the implementation of the plan on an annual basis.). *RESPONSE*: Each year, the Associate Dean of the Full-Time MBA Program will appoint an assessment team that will be responsible for coordinating the annual assessment activities.

2. What is the plan for review of assessment information? (Typically during an annual meeting of the program faculty and staff; note that at this meeting the program may want to review enrollment information, course progress, performance on particular questions on the midterm and final exams, and/or recommendations to support decision making). *RESPONSE*: Annually, the assessment team will draft a summary report and submit it to the Associate Dean of the Full-Time MBA Program for review. Consideration of recommendations will be discussed at the annual meeting of the program faculty and staff. When assessment data are received for learning goals #2 and #3, the percentage of students across those courses earning a B or better will be calculated. If deemed unacceptable, the report will indicate what remedies are to be undertaken together with the analysis supporting those remedies. An additional requirement of each student is an INDIVIDUAL executive summary for a project from one of their certificate courses that: 1) describes the questions addressed; 2) explains the rationale for the design of their model; 3) explains the basis of their recommendations; and 4) describes their learnings through this process. This executive summary is separate and apart from the chosen certificate course and is submitted separately to the certificate administrator. For the first year of this plan, the learning outcomes will be reviewed and updated as necessary and a revised plan will be submitted after revisions (if any) are approved.

3. What is the plan for production of an annual summary report? (The annual summary report includes the materials that form the basis of discussion at the annual meeting of the program faculty and staff, along with any recommendations made after considering the student learning assessment information presented). *RESPONSE*: Annual assessment reports grades in certificate course and an evaluation of a sample of student executive summaries.

4. How will the recommendations be implemented? (Explain the general process by which recommendations will be implemented). *RESPONSE*: Recommendations made by the assessment team will be discussed by the Certificate task force and other relevant faculty and staff members. If the recommendations are approved, they will be presented to the School of Business Master’s Curriculum Committee, as appropriate, with any appropriate governance steps taken thereafter. Approved recommendations will be implemented in a timely fashion, ideally such that the changes can be implemented the next time the course(s) are offered.
19 April 2018

TO: Ella Mae Matsumura, Senior Associate Dean of Academic Programs  
Wisconsin School of Business

FROM: John Karl Scholz, Dean

RE: Request for Comment: Wisconsin School of Business Graduate  
Certificate in Business Analytics

CC: Don Hausch, Associate Dean of Masters Programs, Wisconsin School  
of Business  
Elaine Klein, Associate Dean for Academic Planning  
Sarah Kuba, Academic Planner, Academic Planning and Institutional  
Research  
Lisa Martin, Associate Dean, Graduate School  
Jocelyn Milner, Vice Provost and Director, Academic Planning and  
Institutional Research  
James Montgomery, Associate Dean for Fiscal Initiatives, L&S  
Jennifer Noyes, Associate Dean for Operations and Staff  
Parmesh Ramanathan, Associate Dean, Graduate School  
Eric Wilcots, Deputy Dean

On April 17, 2018, the Academic Planning Council of the College of Letters &  
Science considered the Wisconsin School of Business request to create a new  
graduate certificate program in Business Analytics. Council members noted that  
this proposal has already obtained the support of L&S units most likely to share  
an interest in this topic, due to programming offered in those units; all were  
satisfied that concerns about “overlap” will be avoided. The L&S APC approved  
a recommendation that the college support this proposal.

We wish you and your colleagues all the best as you move forward.
April 5, 2018

Professor Ella Mae Matsumura
Senior Associate Dean of Academic Programs
Robert and Monica Beyer Professor of Accounting
4345 Grainger Hall
975 University Avenue
Madison, WI 53706

Dear Ella Mae,

The Information School is pleased to support the proposal of the UW School of Business (WSB) for a face-to-face Graduate Certificate in Business Analytics. I understand that enrollment will initially be limited to WSB graduate students, but I believe there could be broader campus demand for the proposed certificate. The certificate will give WSB graduate students structured means to gain analytics expertise; further, it will give them a credential to make them more competitive in job seeking. There is high employer demand for applied analytics professionals, and it is important that the UW-Madison campus offer multiple pathways for students to gain expertise in this area.

Sincerely yours,

Kristin R. Eschenfelder
Vilas Distinguished Achievement Professor and Director
Information School
April 9, 2018

Professor Ella Mae Matsumura  
Senior Associate Dean for Academic Programs  
School of Business  
University of Wisconsin-Madison

Dear Ella Mae,

I am writing on behalf of the Department of Statistics to indicate no objections to the School of Business developing the proposed graduate Business Analytics Certificate. Data science and data analytics are the study of the generalizable extraction of knowledge learnt from data. They require statistical data analysis, some computing skills and domain science knowledge. Statistics Department launched a professional master degree on data science four year ago and has merged as a leading master data science program in UW-Madison. Your proposed certificate program is a useful addition to the broader data science offerings of UW-Madison, and we anticipate mutual benefits from the cooperation between our two programs.

Sincerely,

Yazhen Wang  
Professor and Chair  
Department of Statistics  
University of Wisconsin-Madison  
Email: yzwang@stat.wisc.edu
Proposal corrections made by Elaine M. Klein, 5/7/2018, in consultation with Grad School and faculty.

24 April 2018

TO:  Sarah Mangelsdorf, Provost
FROM:  John Karl Scholz, Dean
RE:   Proposal to Create a New Named Option, MS-Physics, “Quantum Computing”
CC:  Sridhara Dasu, Professor and Chair, Physics
     Katy Duren, Associate Dean Division of Continuing Studies
     Robert Joynt, Professor, Physics
     Marty Gustafson, Assistant Dean, Division of Continuing Studies
     Elaine Klein, Associate Dean for Academic Planning, L&S
     Sarah Kuba, Academic Planner, Academic Planning and Institutional Research
     Alex Levchenko, Professor, Physics
     Gloria Mari-Beffa, Associate Dean for the Natural and Mathematical Sciences, L&S
     Lisa Martin, Associate Dean, Graduate School
     Jocelyn Milner, Vice Provost and Director, Academic Planning and Institutional Research
     James Montgomery, Associate Dean for Fiscal Initiatives, L&S
     Jennifer Noyes, Associate Dean for Operations and Staff
     Parmesh Ramanathan, Associate Dean, Graduate School
     Eric Wilcots, Deputy Dean, L&S

On April 17, 2018, the L&S Academic Planning Council considered the attached request to create a new Named Option under the existing MS-Physics, which will focus on the exciting new subfield, “Quantum Computing.” This program has been planned as a 1-year intensive program of study (Fall/Spring/Summer) focused on the application of quantum mechanics to quantum computation; it has been planned as a non-pooled tuition program, in which the revenues generated by the 20-25 students who enroll each year will support the costs associated with the program. Since this program will be situated within the Department of Physics, it will have the benefit of that department’s faculty expertise, governance procedures, and assessment operations.
The faculty and our APC are excited to note that this would be one of the first programs of its kind to offer focused study in this field, and its particular strength is that it will move students from courses focuses on theory into opportunities to work in the laboratory, in spaces where students can conduct experiments designed to test and explore the nature of the physics that will define future technology and innovation. Our colleagues in Computer Science support the proposal, recognizing that this emerging field seeks to understand the foundational physics that will (eventually) inform the development new computing hardware and software technologies – but the physics must come first.

Staff in L&S Administration, including Associate Deans Mari-Beffa and Montgomery, are actively engaged in discussion with the Department to refine the projected budget. As you know, L&S has a robust process for developing and monitoring budgets associated with non-pooled programs, and our prior experience with managing these programs has informed development of this budget. For example, the department is aware that adequate staffing with appropriate expertise (e.g., a professional program coordinator) will help support program success, and this will be built into the budget.

All academic programs in Physics are up-to-date on academic program review, and the Department appears to be in fine shape to expand its program array in this direction. Courses required for the program are on their way toward approval by the University Curriculum Committee. They should be approved by the time the University APC considers this request, and certainly, by the time students enroll in the program. The L&S APC therefore approved this request unanimously, and expressed the hope that timely implementation might allow the faculty to recruit students into the program in 2018-19, with a planned first-enrollment date of Fall 2019.
INSTRUCTIONS FOR PROPOSING NAMED OPTIONS and USE OF PROPOSAL FORM

A named option is a formally documented sub-major within an academic major program. Named options serve as a convenient way to distinguish a distinct curriculum or delivery format within a major. A named option is NOT a new degree or major. Authorization by the Board of Regents to deliver an academic program is at the degree/major level.

PLANNING A NAMED OPTION
- Planning starts with idea development among the program faculty and staff.
- If you are part of a planning group that thinks a named option is a good idea, start to fill out the Named Option Proposal Form.
- When your ideas are starting to take shape, consult with your school/college dean’s office. If you aren’t sure who to talk to in your school/college dean’s office or if you have questions and want to discuss your plans, contact Jocelyn Milner (Jocelyn.Milner@wisc.edu), Director of Academic Planning and Institutional Research.
- When you have a full draft of a completed Named Option Proposal Form, and ideally before school/college approval, send the proposal to Jocelyn Milner (Jocelyn.Milner@wisc.edu) for a check in and proposal review. This will help make sure that the named option meets all components of the UAPC guidelines and will identify any implementation questions.

APPROVAL STEPS FOR A NAMED OPTION
1. The program faculty who are sponsoring the named option (most often a department) formally approve the named option proposal.
2. The school/college that houses the named option considers the named option for approval, usually at the Academic Planning Council.
3. After school/college approval, the dean forwards the proposal to the provost with a copy to the director of Academic Planning and Institutional Research.
4. The provost will seek a recommendation for approval from the University Academic Planning Council.

FOR INFORMATION AND FORMS: [http://apir.wisc.edu/degreesmajorsoptions.htm](http://apir.wisc.edu/degreesmajorsoptions.htm)
At this URL you will find links to the following information:
- These instructions and the Named Option Proposal Form, which includes detailed instructions
- Policy Guidelines for Named Options within Academic Majors, which is the policy framework for the proposal form (adopted April 2016)

QUESTIONS:
Jocelyn Milner, Director, Academic Planning and Institutional Research (jocelyn.milner@wisc.edu)
Sarah Kuba, Academic Planner, APIR (sarah.kuba@wisc.edu)
A named option is a formally documented sub-major within an academic major program. Named options serve as a convenient way to distinguish a distinct curriculum or delivery format within a major. A named option is NOT a new degree or major. Authorization by the Board of Regents to deliver an academic program is at the degree/major level.

This form is to be used in concert with the Policy Guidelines for Named Options within Academic Majors. Complete the form and save as a Microsoft Word document.

1. **Overview**
   1.1. Named Option: Quantum Computing
   1.2. Academic Major: MS-Physics
   1.3. Home Department: Physics
   1.4. School/college: Letters & Science, Collge of
   1.5. Partner department(s)/units/schools/colleges: None
   1.6. Chair of the Major (name, title, email): Alex Levchenko, Professor, levchenko@physics.wisc.edu
   1.7. Primary faculty or staff contact for the proposal (name, title, email): Robert Joynt, Professor, rjjoynt@wisc.edu
   1.8. Primary school/college dean’s office contact (name, title, email): Elaine Klein, Associate Dean, elaine.klein@wisc.edu
   1.9. Briefly describe the type and purpose of the named option.

   The Department of Physics proposes to introduce a new named option in the existing Physics Master’s Degree program. This is a non-pooled tuition revenue program.

   Degree name: Master of Science in Physics
   Option: Quantum Computing

   We propose to introduce a new named option within the Physics Master’s Degree program designed to prepare students in Quantum Computing. We denote this option as the MS-P-QC program. This option is an educational innovation that will serve students seeking to study the physics of quantum computing at an advanced level. Governments and private companies around the world are investing heavily in quantum computing as it makes the transition from a field of pure research to a promising technology. It is a very rapidly growing job market that is currently underserved by universities. We aim to make UW-Madison into the premier training ground in the world for this burgeoning field.

   The MS-P-QC program would be 1-year intensive program. Students would normally enter the program in the Fall semester. The program is intended mainly for students with an undergraduate training in physics, though excellent students with degrees in other STEM fields could also be considered for admission. All required courses will be offered by the Physics Department. Requirements for admission will be consistent with admission to the UW-Madison Graduate School. Only students who have a sufficient level of English proficiency that they will not be required to take English as a Second Language courses will be admitted; if
students do take these courses, we will adhere to L&S’ standard procedure for sharing revenue with that program.

Students would receive a through grounding in quantum mechanics and more specifically in the application of quantum mechanics to quantum computation. The supporting areas of statistical mechanics, solid-state physics and atomic physics would also form part of the classroom training. A unique strength of the Physics Department is excellent advanced instructional lab facilities. All students would be required to master the advanced lab skills involved in quantum computation. Students who graduate from this program will have the tools to succeed as technical staff in modern laboratories that specialize in quantum computing and quantum technologies more generally. They may also use the program as a springboard to Ph.D. programs in Physics and related areas.

The target enrollment for the program is 20-25 students per year. Program revenue will support all costs associated with administration of the program, which will be housed in the Physics Department. It will operate within the existing departmental governance and oversight systems.

The Physics Department has a very strong research effort in quantum computing. Profs. Coppersmith, Eriksson, Ioffe, Joynt, Kolkowitz, Levchenko, McDermott, Saffman, Vavilov, Walker, and Yavuz are all active in the field. This area of research is very new: it barely existed before 2000. As such, the current state of training that students receive in most Physics programs is often haphazard and could greatly benefit from the focused comprehensive approach that we propose. We believe that only one such program currently exists in the world – an interdisciplinary degree offered by the University of Waterloo. However, that degree is an option given to students who have been admitted to other degree programs. The UW program would be unique in the world, since it would stress experimental skills and thus would be very different from the theory-based set of courses that Waterloo offers. We believe that the current situation is such that we could make a very big impact by being the first in the world to offer an actual named option degree in this subject.

*Named option types are described in the* [Policy Guidelines for Named Options within Academic Majors](#): 1. Area of curricular emphasis within the major for undergraduate programs; 2. Honors in the major for undergraduate programs; 3. Area of curricular emphasis within the major for graduate programs; 4. Non-pooled tuition revenue programs; 5. Distance/Online Programs; 6. Off-Campus Location for graduate, professional, or undergraduate programs

1.10. Date form completed: 3/9/2018

2. **Approval Implementation and Expectations for Review**

2.1. School/College Approval Date: 3/20/2018

2.2. GFEC Approval Date (graduate level named options only): Click here to enter a date.

2.3. UAPC Approval Date: Click here to enter a date.

2.4. Expected first term of student enrollment (typically the first fall after UAPC approval): Fall 2019

2.5. Year of three year progress report to GFEC (3 years after first student enrollment; graduate level named options only): 2022

2.6. Year of first program review (5 years after first student enrollment): 2024

2.7. Are all academic programs in the home department up to date for program review? Yes

*APIR will provide a list of programs and most recent review date if needed.*

If no, program reviews need to be completed before a new proposal is advanced at campus level (GFEC and UAPC). Please provide and information related to plans for completion of program reviews:

None
3. Background/Rationale

3.1. How does the named option relate to the major and to other named options in the major, if relevant?

The proposed new named option program is distinct from the existing M.S. program which provides a broad-based training that is not specialized in any particular subfield of physics. The new program would involve classroom preparation in the theory of quantum computing and would also give intensive laboratory training research in that area. In both of these respects it is quite distinct from the regular M.S. degree while still falling appropriately within the discipline of physics and at a level of a Master’s degree.

3.2. What is the purpose of the named option? How does the named option contribute to the mission of the sponsoring unit?

This expansion of our educational program will extend the reach of UW-Madison’s Physics Department into the workforce and around the world. It will also strengthen our existing programs, bringing new faculty, graduate students, and courses into the curriculum and help to align our department with this future direction of science. UW-Madison’s Educational Innovations Program provides a great opportunity to make these exciting improvements.

3.3. What is the evidence that there is a student demand for the named option?

It is good to point out that there is little direct evidence of student demand. Our program would be the first of its kind in the world, according to a survey carried out by the Division of Continuing Studies (see attachment 3.3) This makes it impossible to point to hard data of student numbers in other programs – there aren’t any such programs. That being said, it is widely recognized that quantum technologies represent a major opportunity for information-based economies. Governments around the world are investing heavily in quantum science. In the United Kingdom there is a National Quantum Technologies Programme that is investing £270 million over five years. The European Union has announced a one billion euro flagship program in quantum technologies slated to start in 2018. China announced in September 2017 a decision to invest $10 billion in a National Laboratory for Quantum Information Sciences. We also know from experience around the university that there is considerable demand among Chinese students for training abroad. The US Government investment is also substantial and is currently distributed across multiple funding agencies including NSF, DOD, DARPA, IARPA, and DOE. Google, Microsoft, and Intel have all started large research efforts but only very recently. Thus the DCS survey shows a modest domestic demand for employees with expertise in quantum science, spread over a number of high-tech companies. We expect this to grow as the field moves from the realm of pure science to mature technology.

Many countries are investing massively in this field as noted above. However, in most cases they have difficulty in training people, as to date most other countries trail the US significantly in developing quantum computing. UW-Madison’s expertise and facilities are unmatched in this area. Thus we expect strong interest from international students in the new program. On the domestic side, we have deep connections at Google, Microsoft, and Intel. Many of our graduates are already employed at these places, and we have research collaborations there as well. We expect good job placement opportunities at these companies and hope to develop their interest in using us to train their current employees. The same is true for the US national laboratories, particularly the Laboratory for Physical Sciences.

4. Curriculum

4.1. Delivery modality:

   Face-to-face

   Distance-delivered programs are those programs in which 50% or more of the required courses may be taken as distance-delivered courses. If the option is intended to provide a way to distinguish between students in a face-to-face or an online/distance delivered program, the provide information on how the distance program is developed and supported in 10.1.

4.2. Provide a complete list of named option requirements.
Credits: 30 credits, of which 15 or more must be at the graduate level (numbered 500 or above).

Courses: Courses for the degree are all offered by the Physics Department. Course offered by other departments will be allowed only in exceptional circumstances, and must be approved by the MS-QC Committee.

Grades: Students must achieve an overall GPA of 3.0 or better.

Advising: Students will work with MS-P-QC faculty to develop a plan of study. Students will meet with a MS-P-QC faculty advisor soon after they arrive to do this. We note that the required courses will provide 12 of the 15 necessary graduate level credits. We will also apply to have Physics 531, 545, and 551 carry the “Graduate 50% Y” standing, as several of the Physics 500-level courses already do. This would mean that all students will satisfy the graduate credit requirement. Still, careful advising will be required to ensure this.

Residence requirement: A minimum of 16 graduate credits must be earned in residence at UW-Madison.

Time limit: This is a program designed to be completed in one year. In exceptional circumstances, the Chair of the MS-P-QC Committee may allow an extension of up to two years total. Also see Attachment 4.3 for further details.

Fall: Physics 531 Introduction to Quantum Mechanics or 731 Quantum Mechanics (3 credits) [Faculty]
Physics 415 Thermal Physics or 715 Statistical Mechanics [Faculty]
Physics 579 Introduction to Quantum Computing (3 credits) [QC Faculty]
Physics Elective (3 credits)

Spring: Physics 551 Solid State Physics or 751 Advanced Solid State Physics [Faculty]
Physics 449 Atomic and Quantum Physics or 545 Introduction to Atomic Structure (3 credits) [Faculty]
Physics 779 Advanced Quantum Computing (3 credits) [QC Faculty]
Physics Elective (3 credits)

Summer: Physics 707 Quantum Computing Laboratory [4 credits] [QC Faculty or Staff]
Physics 799 Directed Study (2 credits) [QC Faculty]

Courses in bold are being developed, and course proposals will be submitted after L&S APC approval of this program proposal. We expect that these courses will be approved and ready to teach by Fall 2019.

Program requirements should provide content that leads to the completion of major learning goals. See section 5 Assessment.

4.3. ☒ Attach a full curriculum including all required and elective courses.

4.4. ☐ For undergraduate named options, attach a four year roadmap.

Named options for undergraduate majors will have requirements totaling 120 credits and students should be able to complete the degree/major within four academic years.

4.5. ☒ For graduate named options, attach a chart outlining minimum degree requirements and elements for satisfactory progress.

Master’s level programs will include at least 30 credits of requirements. Doctoral level programs will include at least 51 credits of requirements.

Checklist for Verification of Curricular Policy Requirements *
You will have an opportunity to provide explanation and rationale for any Curricular Policy Requirements that have not been affirmed in the text box that follows the check list, below.

☒ Courses are offered on a regular basis.
☒ Courses have enrollment capacity for students in the named option.
☐ All courses required for the named option are fully approved.
Units must maintain Named Option requirements so that they are up-to-date; all curriculum changes must be approved through the appropriate school/college academic planning council (APC) or curriculum committee. The school/college APC or curriculum committee will notify the Office of the Registrar and the Graduate School (graduate level named options only) about approved curricular changes to the named option. Typically, any changes in requirements will be effective no sooner than the fall semester after approval.

*Provide explanation and rationale for any Curricular Policy Requirements that have not been affirmed.

Three new courses will be needed for the new named option, Physics 579, Introduction to Quantum Computing, Physics 779, Advanced Quantum Computing, and Physics 707, Quantum Computing Laboratory. The course proposals are under development. It is anticipated that they will be approved in time for enrollment in Fall of 2019.

5. Assessment

5.1. Attach a program assessment plan when submitting this proposal.

Assessment plans for a named option should be integrated with the assessment plan for the major. See the Basic Assessment Plan for instruction and accompanying template. The Basic Assessment Plan and Template are minimum expectations for this information. Programs that have developed plans that exceed what is specified in the basic plan may provide that information.

5.2. Provide a summary of the program assessment plan, including learning goals for the major and any additional learning goals that are specific for the named option, key methods and assessment approaches, and how assessment information will be reviewed and acted on.

The proposed MS-P-QC program is meant mainly as an intensive course of study in a new field of science and technology.

Program success will be seen if the students develop the knowledge and skills that enable them to succeed in the workforce. This will be measured initially by our success in placing graduates. In the longer term we hope to see our graduates take leading roles in this new industry.

As a faculty, our success will be measured by development of our departmental educational and research program to help our students succeed, as we enhance our curriculum to address topics of increasing importance in the 21st century. The new program will help our teaching program to more faithfully reflect the recent changes in our research directions. This will enhance the synergy between instruction and research that is the hallmark of the great modern university.

In our current (overarching) M.S.-Physics, students are expected to obtain the following:

Knowledge and Skills
- Mastery of the core physical concepts (classical mechanics, electricity and magnetism, quantum mechanics, and statistical mechanics).
- Articulates, critiques, or elaborates the theories, research methods, and approaches to inquiry or schools of practice in physics.
- Identifies sources and assembles evidence pertaining to questions or challenges in physics.
- Demonstrates understanding of the physics in an historical, social, or global context.
- Selects and/or utilizes the most appropriate methodologies and practices.
- Evaluates or synthesizes information pertaining to questions or challenges in physics.
- Communicates clearly in ways appropriate to the field of physics.

Professional Conduct:
- Recognizes and applies principles of ethical and professional conduct.
While we believe these goals are applicable to the new MS-P-QC program, we will need to acknowledge that the training in this program is more specialized as to subject matter, but that it is also more applied. Thus, while the learning goals will remain the same, the tools we use to evaluate students, and the analysis we conduct, will be oriented to discern how students’ growing expertise in Quantum Computing is evidenced within these goals. So, for example, we will expect students in this program to know and be able to:

- Master the physical and mathematical concepts of quantum computing (quantum mechanics, statistical mechanics, quantum algorithms, quantum information);
- Articulate, critique, or elaborate the theories, research methods, and technologies of quantum computing;
- Identify sources and assemble evidence pertaining to questions or challenges in quantum computing, both the physical basis and the computational results;
- Demonstrates understanding of quantum computing in an historical, social, or global context.; and so on.

Assessment of learning

The MS-P-QC committee will be responsible for the assessment of learning success, in collaboration with the Associate Chair for Graduate Education and the Graduate Program Committee. This is divided into direct and indirect measures of learning.

Direct measures:

We will monitor the success of the students in the required courses. Based on the performance on exams we will assess whether the students can meet the goals outlined above. Instructors will provide input on how the M.S. students perform in comparison with advanced undergraduates and other graduate students enrolled in those courses.

Indirect measures:

We will track the placement of our graduates into industry or government and into Ph.D. programs. We will utilize the exit survey of the Graduate School to access the students’ own assessment of their experience.

We will act on this information as appropriate. Some examples are: The topics covered in the curriculum can be adjusted if exit surveys show dissatisfaction; if there are significant discrepancies in the performance of the MS-P-QC students relative to other students, we may need to revise our advising or our admissions standards. Other contingencies can be imagined. In general, a completely new program can be expected to undergo some tweaking in the early years.

The assessment summary should highlight how the named option is included in the overall assessment plan for the major. The named option must adhere to all learning goals for the major and may also have additional learning goals that are specific for the named option.

6. Overlap and Related Programs

6.1. Specify any other degree/majors, named options, or certificates that may not be earned in combination with this named option.

Students in this program cannot be admitted to other programs within the department while enrolled in this program, nor will they be allowed to complete any other degree program while enrolled in this program.

Overlap restrictions must be managed at the program level as part of the advising process. When proposing a named option that has the same name as an existing degree/major certificate or doctoral minor at the same level, the program will be required to put in place processes to ensure that students do not enroll in both programs with the same name. If the program faculty choose to limit any other overlap with other degree/majors, named options, or
certificates a list must be specified in the proposal and the program faculty/staff will be responsible for monitoring and enforcing overlap limits.

7. Admissions & Enrollment

7.1. For graduate programs proposing a named option with admissions requirements that are distinct from the major with no named option, explain the admissions criteria and process. Applicants should have a bachelor’s degree in Physics or a closely related STEM field. Applications will be judged on the same general criteria used for the current M.S. Program. These are: quality of undergraduate transcript, (or graduate transcript, if applicable), letters of recommendation, scores on standardized tests, and personal statement. For admitted international students who are subject to Graduate School policies regarding English proficiency, English proficiency test scores must be submitted. Admission will be limited to students whose scores are higher than the minimum threshold for admission, with an expectation that no students admitted will require additional instruction in English as a Second Language. The admission process may involve in-person, telephone or online interviews to assess communication skills in cases of students whose undergraduate instruction was not in English.

7.2. What is the projected annual enrollment in the named option? 20-25
7.3. What is the maximum enrollment (using existing instructional and student resources)? 30
7.4. What are the contingency plans for supporting enrollments higher than the stated maximum enrollment? Because this is a graduate program with an admissions procedure, we should be able to ensure that enrollments will not exceed our maximum. (Indeed, we think it is extremely unlikely that we will have more than 30 students per cohort.) That said, classroom courses have sufficient elasticity to absorb higher enrollments, both in terms of space and in terms of department resources for TA and grading help. As is usually the case with lab-based courses, enrollment limits are mostly defined by lab setups available for key courses. In this case, Physics 707, Quantum Computing Laboratory could be a limiting factor. This course is planned to be offered in summer so equipment from other instructional labs is available; as planned, the course will accommodate 30 students. If we were to exceed that maximum, we could press into service other lab setups that are less relevant to Quantum Computing, but still useful to students. Finally, of course, since this is proposed to be a non-pooled tuition program, if we were to determine that expansion of the program is warranted, revenues could be reinvested strategically to support that expansion.

Checklist for Verification of Admission Policy Requirements for Undergraduate Named Options*

You will have an opportunity to provide explanation and rationale for any Admission Policy Requirements that have not been affirmed in the text box that follows the checklist.

☐ Named option admission requirements are consistent with admission requirements for the major with no named option, if the major has any admission requirements beyond admission to the University. Admission limits should be related to interest or aptitude for the content and not based solely on a high GPA cutoff

☐ The named option will be declared and canceled using the e-Declaration process in the student information system.

☐ Undergraduates will not be advised to declare or remain enrolled in a named option if it will extend their time to graduation. Undergraduate students are to be discouraged from earning more than one named option that represents an area of curricular emphasis within the major.

*Provide explanation and rationale for any Admission Policy Requirements that have not been affirmed in the above checklist.

Type explanations for Admission Policy Requirements not affirmed here.

8. Advising
8.1. List name(s) of major and named option advisor(s) with title and departmental affiliation(s).

8.2. Describe how there will be sufficient advising and academic support for all students in the major (both the existing major’s students and the new students that will be served by the named option).

The enrollment in the existing M.S. program is extremely small - less than one student per year, on average. This is easily handled by Prof. Levchenko, who is the Associate Chair of the Department for the Graduate Program. In the new named option, each student will be assigned an advisor from the above list of 11 persons, each of whom is active in quantum computing research. These assignments will be made by the MS-P-QC committee, appointed by the chair of the new program in consultation with the chair of the department. This committee will have 3-4 members, chosen from the faculty with expertise in the area, as already listed in Sec. 8.1 above. Since the number of faculty involved (11) is rather large, this is only a small adjustment in the usual service of any faculty member. In addition, the flexibility in choice of courses is relatively small, so the advising task for faculty is much less than for a typical program. We do note that the advising for this program will include some amount of job placement advising in addition to more conventional academic advising. Since the faculty in this particular area are knowledgeable about opportunities in the field, they will be the ones responsible for this side of things as well. We are fortunate to have a Board of Visitors for the department in which high-tech companies are well-represented. They will also serve as a resource. The main additional work will be for the faculty program chair, who is provided with one month's summer salary. This person will have the assistance of a dedicated 50%-time support person to handle administrative details. The support staff member will have administrative responsibilities that are similar to the current responsibilities involved in administration of the existing M.S. and Ph.D. programs, but tailored to specific needs of the new program.

8.3. ☒ Confirm that major and named option advisor(s) have been consulted and reviewed this proposal.

9. Governance & Faculty

9.1. ☒ The named option must be governed by the same department or academic unit that oversees the major. Any sub-committee governing the named option must report to the faculty governance committee for the major.

9.1.1. If a sub-committee governs the named option, describe procedures including how faculty are identified and provisions for transitions in the committee.

The faculty of the Physics Department will have governance authority over the new Masters option in Quantum Computing (MS--PQC). There will be an MS-P-QC Committee of 3-4 faculty with rotating membership, and an MS-P-QC Program Director that will chair this committee. Faculty agree to serve for a 3-year period during which they are responsible for assisting students in the program and monitoring their progress. The committee will also ensure that the students in this program have appropriate priority in the required courses, or that new sections are opened, in case the courses are oversubscribed. The department faculty will oversee the admissions process for the new program with assistance from the MS-P-QC committee. The MS-P-QC Committee will also be responsible for oversight of the advising of the MS-P-QC students. Decision by the MS-P-QC Committee will be approved through Physics Department governance (i.e. the Executive Committee).

9.2. List core faculty and staff with title and departmental affiliation(s).
10. Fiscal Structure and Ongoing Commitment

10.1. Provide an overview of plans for funding the named option including but not limited to program administration, instructional/curricular delivery, technology needs, and program assessment.

The Master's program is expected to be fully self-supporting, consistent with the L&S revenue-sharing model used for other non-pooled tuition programs. The department will allocate any additional revenue to strengthen the core teaching and research missions of the Department.

The new program will increase enrollment in our existing advanced undergraduate and graduate courses. The increased number of students will be spread over a large number of upper-level courses which have elastic enrollment. It also involves three new courses. Costs associated with teaching MS-PQC students in existing courses, as well as the need to increase in teaching effort by adding new courses and instructional staff will be funded by program revenue. We do not anticipate any equipment costs as we intend to use existing equipment for the new lab course. If the program is expanded in future, impacts on instructional and equipment needs will be assessed and planned in light of program revenue.

The details of the budget reflect the instructional faculty/staff time devoted to new sections as well as extra students in existing sections. There will also be a budget amount allocated to more hours for grading homework. The budget will account for faculty/staff time for admissions work, program assessment and program support such as faculty advising. An administrative staff member will be designated as MS-P-QC coordinator. Support for this person is included in the budget. It has not been decided whether this will be a new hire or a conversion from part time to full time. Other campus resources should not be required. In particular, the students are not required or expected to enroll in ESL courses since their English proficiency should be sufficiently high that they will not be required to take ESL. Indeed students will be advised that they will not be allowed to take ESL strictly of their own volition. We are aware that the college will monitor students' enrollment in ESL.

Students in this program revenue program are not eligible for any TA, RA or PA support, so no budget is allocated to student stipends.

The following are the annual budget items rounded to the nearest $1,000 (fringe costs included) based on a 25-student cohort. The plan is to reach this class size in 2021.

Administrative support ($45K)
Faculty director ($25K)
Instructors at staff level for 4.5 courses ($148K)
Teaching Assistant Support ($36K)
Grading support ($5K)

This totals $259 expenses, to be offset by income. Tuition is to be set at $1,600 per credit, pending Regent approval. Total income, based on ⅔ of tuition of 25 students, would be $832K assuming 100% non-residents. We expect very few state residents in the program. A detailed budget is attached (see attachment 10.1)

10.2. How will the named option impact staffing needs beyond the immediate program? How are those needs being met?

The program requires the establishment of 3 new courses. This will require the hiring of new teaching staff, which is budgeted at the instructor level. It is anticipated that the instructors...
will teach elementary courses, freeing up faculty for the new courses. Physics 707, a lab course, is a possible exception. It could be taught by an experienced instructor. The program will have a faculty director. The position is expected to be somewhat time-consuming and 1 month of summer salary will be budgeted for it. The program will require administrative support, at the level of the graduate program secretary. The addition of 25 students means an increase of the graduate program by about 15%. The new courses are upper-level courses. We have also budgeted for one TA position. Grading support will be needed so we have included this as a budget item.

*If there is no change in staffing, please describe how the duties of current employees will evolve to support this named option.*

10.3. For named options supported using **non-pooled tuition**, provide a fiscal annual summary including planned enrollment, estimated paid tuition, instructional costs, and estimated excess tuition available for reinvestment in keeping with the separate guidelines for non-pooled programs.

See Attachment titled “Annual Fiscal Summary”

10.4. For graduate programs supported using **pooled tuition**, provide a plan for how new graduate students will be funded.

N/A

**Required attachments**

☐ Cover letter from the Dean of the school/college that will be the home of the named option

*When a proposal for a new named option is forwarded for approval, it will have a cover letter to the provost from the supporting dean.*

☒ Supporting letters/memos

*Proposals must be accompanied by letters or memos submitted by the chair or director of other academic units that have overlapping interest. These notes may comment on shared resources, competition for students or other ways in which the programs will interact surrounding the named option. This will include departments/schools/colleges, share a student audience, represent a closely related area of study, have overlapping faculty, or have program names that are similar.*

☒ Full curriculum including all required and elective courses

☐ For undergraduate named options, attach a four year roadmap.

☒ For graduate named options, attach a [chart outlining minimum degree requirements and elements for satisfactory progress](https://kb.wisc.edu/веста/page.php?id=59300).

☒ Assessment plan

Named options supported using non-pooled tuition must attach:

☒ Core Criteria Checklist

☒ Additional Requirements Checklist

*See the current Non-pooled Program Requirements Process document posted at [https://kb.wisc.edu/веста/page.php?id=59300](https://kb.wisc.edu/vesta/page.php?id=59300)*
Burning Glass Filter:

O*Net Occupation
- Physicists

AND Keywords
- “quantum computing”
- “quantum technologies”
- “quantum mechanics”

AND Time Period
- Full year 2017 (unless specified otherwise)

AND Location
- Nationwide

And Advertised Education
- Any level

Education
First chart shows minimum education level advertised in job postings
Second chart includes postings for both preferred and minimum education required so postings may be counted in more than one category

Minimum Education Advertised

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor's degree</td>
<td>10</td>
</tr>
<tr>
<td>Doctoral degree</td>
<td>46</td>
</tr>
</tbody>
</table>

All Advertised (includes preferred and minimum education requirements)

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor's degree</td>
<td>10</td>
</tr>
<tr>
<td>Master's degree</td>
<td>3</td>
</tr>
<tr>
<td>Doctoral degree</td>
<td>56</td>
</tr>
</tbody>
</table>
Job Postings
Number of jobs posted in 2017

Any Education Level

<table>
<thead>
<tr>
<th># Postings in 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
</tr>
</tbody>
</table>

Job Titles
Top most common job titles and number of postings for each title

Physicist
Quantum Information Research Scientist 4
Frequency Comb Scientist 3
Optical Systems Research Scientist 3
Quantum Scientist 2
Quantum Computing Exploration Research Scientist 1
Post-Doctoral Associate in Experimental Condensed Matter Physics 1
Quantum Modeling Scientist 1
Quantum Modeling Scientist In, At Boo2 1
Quantum Modeling Scientist In, At Boo2 Hamil 1
Research Scientist For Quantum Computing 1
Post-Doctoral Candidate, Department Of Physics 1
### Location
Top states with the most job postings. Time period is Last 12 months (3/1/17 – 2/28/18)

<table>
<thead>
<tr>
<th>State</th>
<th>Job Postings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maryland</td>
<td>16</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>15</td>
</tr>
<tr>
<td>District of Columbia</td>
<td>15</td>
</tr>
<tr>
<td>New Jersey</td>
<td>10</td>
</tr>
<tr>
<td>New York</td>
<td>4</td>
</tr>
<tr>
<td>California</td>
<td>3</td>
</tr>
<tr>
<td>Colorado</td>
<td>3</td>
</tr>
<tr>
<td>Maine</td>
<td>2</td>
</tr>
<tr>
<td>New Mexico</td>
<td>2</td>
</tr>
<tr>
<td>Utah</td>
<td>1</td>
</tr>
<tr>
<td>Washington</td>
<td>1</td>
</tr>
</tbody>
</table>

### Industry
Top industries (with 4-digit NAICS code from the US Census Bureau) and number of postings in each industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Job Postings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace Product and Parts Manufacturing (3364)</td>
<td>20</td>
</tr>
<tr>
<td>Management, Scientific, and Technical Consulting Services (5416)</td>
<td>14</td>
</tr>
<tr>
<td>Scientific Research and Development Services (5417)</td>
<td>5</td>
</tr>
<tr>
<td>Computer Systems Design and Related Services (5415)</td>
<td>4</td>
</tr>
<tr>
<td>Colleges, Universities, and Professional Schools (6113)</td>
<td>3</td>
</tr>
<tr>
<td>Semiconductor and Other Electronic Component Manufacturing (3344)</td>
<td>2</td>
</tr>
<tr>
<td>Navigational, Measuring, Electromedical, and Control Instruments Manufacturing (3345)</td>
<td>2</td>
</tr>
<tr>
<td>Support Activities for Mining (2131)</td>
<td>1</td>
</tr>
</tbody>
</table>
Employers
Top employers posting these jobs and number of postings from each employer

<table>
<thead>
<tr>
<th>Employer</th>
<th>Number of Postings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northrop Grumman</td>
<td>20</td>
</tr>
<tr>
<td>Booz Allen Hamilton Inc.</td>
<td>12</td>
</tr>
<tr>
<td>Vencore</td>
<td>7</td>
</tr>
<tr>
<td>MITRE Corporation</td>
<td>4</td>
</tr>
<tr>
<td>Toptica Photonics Incorporated</td>
<td>3</td>
</tr>
<tr>
<td>Raytheon</td>
<td>2</td>
</tr>
<tr>
<td>Sandia Corporation</td>
<td>2</td>
</tr>
<tr>
<td>IBM</td>
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<tr>
<td>Microsemi Corporation</td>
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</tr>
<tr>
<td>Colorado State University</td>
<td>1</td>
</tr>
<tr>
<td>Kla Titon Corporation</td>
<td>1</td>
</tr>
<tr>
<td>Rutgers, the State University of New Jersey</td>
<td>1</td>
</tr>
<tr>
<td>Universities Space Research Association</td>
<td>1</td>
</tr>
</tbody>
</table>

Skills
Skills (baseline, specialized, & software and programming) desired in these job postings and the number of postings requesting the skill

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Specialized</th>
<th>Software and Programming</th>
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</thead>
<tbody>
<tr>
<td>Research</td>
<td>35</td>
<td>49</td>
</tr>
<tr>
<td>Team Work/ Collaboration</td>
<td>13</td>
<td>37</td>
</tr>
<tr>
<td>Mathematics</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Writing</td>
<td>9</td>
<td>12</td>
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<tr>
<td>Troubleshooting</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Communication Skills</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Creativity</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Persuasion</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Problem Solving</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Detail-Oriented</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Editing</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Research</td>
<td>35</td>
<td>49</td>
</tr>
<tr>
<td>Team Work/ Collaboration</td>
<td>13</td>
<td>37</td>
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<tr>
<td>Mathematics</td>
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<td>12</td>
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<tr>
<td>Troubleshooting</td>
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<tr>
<td>Communication Skills</td>
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<tr>
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<tr>
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<td>Detail-Oriented</td>
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<tr>
<td>Skill</td>
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<td>Description</td>
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<tr>
<td>Self-Motivation</td>
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<tr>
<td>Strategic Planning</td>
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<tr>
<td>Analytical Skills</td>
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<tr>
<td>Organizational Skills</td>
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<tr>
<td>Prioritizing Tasks</td>
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<tr>
<td>Prioritizing Tasks</td>
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<tr>
<td>Calibrating</td>
<td>3</td>
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<tr>
<td>Computer Engineering</td>
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<td></td>
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<tr>
<td>Customer Contact</td>
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<td></td>
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<tr>
<td>Debugging</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Description and Demonstration of Products</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Expense Reports</td>
<td>3</td>
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<td>Laboratory Testing</td>
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<tr>
<td>Laboratory Testing</td>
<td>3</td>
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<tr>
<td>MATLAB</td>
<td>3</td>
<td></td>
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<tr>
<td>Machine Learning</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**Burning Glass Filter:**

**AND Keywords**

- “quantum computing”
- “quantum technologies”
- “quantum mechanics”

**AND Time Period**

- Full year 2017 (unless specified otherwise)

**AND Location**

- Nationwide
**Education**

First chart shows minimum education level advertised in job postings

Second chart includes postings for both preferred and minimum education required so postings may be counted in more than one category

---

**Minimum Education Advertised**

- High school or vocational training: 48
- Associate’s degree: 24
- Bachelor’s degree: 630
- Master’s degree: 56
- Doctoral degree: 163

---

**All Advertised (includes preferred and minimum education requirements)**

- High school or vocational training: 48
- Associate’s degree: 37
- Bachelor’s degree: 677
- Master’s degree: 378
- Doctoral degree: 334

---

**Job Postings**

Number of jobs posted in 2016 and 2017

**Any Education Level**

- 2017: 1,007
- 2016: 421
### Job Titles

Top 25 most common job titles and number of postings for each title

#### Master’s Degree (preferred or minimum)

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Number of Postings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems Engineer</td>
<td>11</td>
</tr>
<tr>
<td>Software Development Engineer</td>
<td>10</td>
</tr>
<tr>
<td>Contract Manager</td>
<td>8</td>
</tr>
<tr>
<td>Engineering Manager</td>
<td>7</td>
</tr>
<tr>
<td>Analyst, Quantum Technologies</td>
<td>6</td>
</tr>
<tr>
<td>Chief Engineer</td>
<td>6</td>
</tr>
<tr>
<td>Mechanical Engineer</td>
<td>6</td>
</tr>
<tr>
<td>Security Manager</td>
<td>6</td>
</tr>
<tr>
<td>RF Engineer</td>
<td>5</td>
</tr>
<tr>
<td>Principal Systems Engineer</td>
<td>5</td>
</tr>
<tr>
<td>Financial Analyst</td>
<td>5</td>
</tr>
<tr>
<td>Electrical Engineer</td>
<td>5</td>
</tr>
<tr>
<td>Senior Systems Engineer</td>
<td>5</td>
</tr>
<tr>
<td>Senior Support Engineer</td>
<td>4</td>
</tr>
<tr>
<td>Sales Engineer</td>
<td>4</td>
</tr>
<tr>
<td>Research Data Scientist</td>
<td>4</td>
</tr>
<tr>
<td>OEM Sales Leader</td>
<td>4</td>
</tr>
<tr>
<td>Senior Electrical Engineer</td>
<td>4</td>
</tr>
<tr>
<td>Security Engineer</td>
<td>4</td>
</tr>
<tr>
<td>University Programs Electrical Engineering Intern, Junior, Senior, Graduate</td>
<td>3</td>
</tr>
<tr>
<td>Hardware Engineer</td>
<td>3</td>
</tr>
<tr>
<td>Business Development Manager</td>
<td>3</td>
</tr>
<tr>
<td>Business Development Professional</td>
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</tr>
<tr>
<td>Director of Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Information Technology Manager</td>
<td>3</td>
</tr>
</tbody>
</table>
Location

Top 15 states with the most job postings. On the map, the darker the blue the more job postings in that state.

Time period is Last 12 months (3/1/17 – 2/28/18)

Master’s Degree (preferred or minimum)
<table>
<thead>
<tr>
<th>State</th>
<th>Job Postings</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>208</td>
</tr>
<tr>
<td>Texas</td>
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<tr>
<td>Massachusetts</td>
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<tr>
<td>Virginia</td>
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<tr>
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<tr>
<td>Washington</td>
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<tr>
<td>New York</td>
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<tr>
<td>Florida</td>
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<tr>
<td>Mississippi</td>
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<tr>
<td>Georgia</td>
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<tr>
<td>Maryland</td>
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</tr>
<tr>
<td>District of Columbia</td>
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<tr>
<td>New Hampshire</td>
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<tr>
<td>New Mexico</td>
<td>6</td>
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<tr>
<td>Utah</td>
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</tr>
<tr>
<td>Industry</td>
<td>Number of Postings</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Navigational, Measuring, Electromedical, and Control Instruments Manufacturing (3345)</td>
<td>247</td>
</tr>
<tr>
<td>Management, Scientific, and Technical Consulting Services (5416)</td>
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</tr>
<tr>
<td>Scientific Research and Development Services (5417)</td>
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<tr>
<td>Software Publishers (5112)</td>
<td>13</td>
</tr>
<tr>
<td>Colleges, Universities, and Professional Schools (6113)</td>
<td>12</td>
</tr>
<tr>
<td>Aerospace Product and Parts Manufacturing (3364)</td>
<td>9</td>
</tr>
<tr>
<td>Oil and Gas Extraction (2111)</td>
<td>5</td>
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<tr>
<td>Semiconductor and Other Electronic Component Manufacturing (3344)</td>
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<tr>
<td>Motor Vehicle Manufacturing (3361)</td>
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<td>Automobile Dealers (4411)</td>
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<td>Museums, Historical Sites, and Similar Institutions (7121)</td>
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<td>Electronic Shopping and Mail-Order Houses (4541)</td>
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<td>Beverage Manufacturing (3121)</td>
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<td>Administration of Economic Program (9261)</td>
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<td>Communications Equipment Manufacturing (3342)</td>
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<td>Junior Colleges (6112)</td>
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<tr>
<td>National Security and International Affairs (9281)</td>
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<tr>
<td>Other Investment Pools and Funds (5259)</td>
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<td>Outpatient Care Centers (6214)</td>
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<tr>
<td>Pharmaceutical and Medicine Manufacturing (3254)</td>
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<td>Securities and Commodity Contracts Intermediation and Brokerage (5231)</td>
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<td>Space Research and Technology (9271)</td>
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<td>Wireless Telecommunications Carriers (except Satellite) (5172)</td>
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### Master’s Degree (preferred or minimum)

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<th>Employer</th>
<th>Postings</th>
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<td>Raytheon</td>
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<td>Booz Allen Hamilton Inc.</td>
<td>16</td>
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<tr>
<td>Rigetti &amp; Co. Inc</td>
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<tr>
<td>Microsoft Corporation</td>
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<td>Lockheed Martin Corporation</td>
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<tr>
<td>SAP</td>
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</tr>
<tr>
<td>Ford Motor Company</td>
<td>5</td>
</tr>
<tr>
<td>Kla Tencor Corporation</td>
<td>4</td>
</tr>
<tr>
<td>Teptica Photonics Incorporated</td>
<td>4</td>
</tr>
<tr>
<td>Pacific Northwest National Laboratory</td>
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<tr>
<td>Northrop Grumman</td>
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<td>Argonne National Laboratory</td>
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<td>Sandia Corporation</td>
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<tr>
<td>Montana Instruments</td>
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<td>Amazon.com</td>
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<td>Accenture</td>
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<td>Atos SE</td>
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<td>Lincoln Laboratory</td>
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<tr>
<td>Anheuser-Busch Companies, Inc.</td>
<td>2</td>
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<tr>
<td>Nasa’s Jet Propulsion Laboratory</td>
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<tr>
<td>Quantum Reservoir Impact</td>
<td>2</td>
</tr>
<tr>
<td>Sap J2W</td>
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<td>University of Illinois</td>
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<td>AT&amp;T</td>
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<td>Amgen</td>
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</table>

Total Postings: 254
### Skills

Skills (baseline, specialized, & software and programming) desired in these job postings and the number of postings requesting the skill

**Master’s Degree (preferred or minimum)**

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Specialized</th>
<th>Software and Programming</th>
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</thead>
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<tr>
<td>Communication Skills</td>
<td>Electrical Engineering</td>
<td>MATLAB</td>
</tr>
<tr>
<td>Mathematics</td>
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<td>Writing</td>
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<td>Research</td>
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<td></td>
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<tr>
<td>Problem Solving</td>
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<tr>
<td>Planning</td>
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<td></td>
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<tr>
<td>Team Work/ Collaboration</td>
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<tr>
<td>Multi-Tasking</td>
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<tr>
<td>Presentation Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
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<td></td>
</tr>
<tr>
<td>Creativity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Troubleshooting</td>
<td></td>
<td></td>
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<tr>
<td>Self- Starter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building Effective Relationships</td>
<td></td>
<td></td>
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<tr>
<td>Mentoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational Skills</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Baseline**: 168
- **Specialized**: 124
- **Software and Programming**: 64
<table>
<thead>
<tr>
<th>Analytical Skills</th>
<th>29</th>
<th>Hardware Experience</th>
<th>45</th>
<th>Real-Time Operating System (RTOS)</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Analysis</td>
<td>26</td>
<td>Microsoft Office</td>
<td>45</td>
<td>Software as a Service (SaaS)</td>
<td>11</td>
</tr>
<tr>
<td>Detail-Oriented</td>
<td>25</td>
<td>Simulation</td>
<td>45</td>
<td>Microsoft C#</td>
<td>10</td>
</tr>
<tr>
<td>Management</td>
<td>21</td>
<td>Mechanical Engineering</td>
<td>44</td>
<td>Platform as a Service (PaaS)</td>
<td>9</td>
</tr>
<tr>
<td>Decision Making</td>
<td>20</td>
<td>Project Management</td>
<td>43</td>
<td>UNIX</td>
<td>9</td>
</tr>
<tr>
<td>Articulate</td>
<td>19</td>
<td>Machine Learning</td>
<td>41</td>
<td>Microsoft Access</td>
<td>8</td>
</tr>
<tr>
<td>Computer Skills</td>
<td>19</td>
<td>System Design</td>
<td>39</td>
<td>Eclipse</td>
<td>7</td>
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<tr>
<td>Strategic Planning</td>
<td>13</td>
<td>Process Improvement</td>
<td>35</td>
<td>Finite Element Analysis</td>
<td>7</td>
</tr>
<tr>
<td>Team Building</td>
<td>13</td>
<td>Proposal Writing</td>
<td>34</td>
<td>Xilinx</td>
<td>7</td>
</tr>
</tbody>
</table>
Attachment 4.3
Full Curriculum

MS-QC Curriculum (maximum of 12 credits per semester)

Fall:
- Physics 531 Introduction to Quantum Physics or 731 Quantum Mechanics (3 credits) [Faculty]
- Physics 415 Thermal Physics or 715 Statistical Mechanics [Faculty]
- **Physics 879 Introduction to Quantum Computing (3 credits)** [QC Faculty]
- Physics Elective (3 credits)

Spring:
- Physics 551 Solid State Physics or 751 Advanced Solid State Physics [Faculty]
- Physics 449 Atomic and Quantum Physics or
  - 545 Introduction to Atomic Structure (3 credits) [Faculty]
- **Physics 779 Advanced Quantum Computing (3 credits)** [QC Faculty]
- Physics Elective (3 credits)

Summer:
- **Physics 707 Quantum Computing Laboratory (4 credits)** [QC Faculty or Staff]
- Physics 799 Directed Study (2 credits) [QC Faculty]

Courses in bold are being developed, and course proposals will be submitted after L&S APC approval of this program proposal. We expect that these courses will be approved and ready to teach by Fall 2019. The list of faculty members active in quantum computing research (“QC faculty”) is: Profs. Coppersmith, Eriksson, Ioffe, Joynt, Kolkowitz, Levchenko, McDermott, Saffman, Vavilov, Walker, and Yavuz.
## Attachment 4.5

### Minimum Degree Requirements Chart

<table>
<thead>
<tr>
<th>Master’s Degrees offered in Physics:</th>
<th>M.A., M.S., M.S.-Q.C Named Option (proposed)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum Graduate Degree Credit Requirement</strong></td>
<td>M.A. – 30 credits, M.S. – 30 credits M.S.-Q.C Named Option – 30 credits</td>
</tr>
<tr>
<td><strong>Minimum Graduate Residence Credit Requirement</strong></td>
<td>M.A. – 16 credits, M.S. – 16 credits M.S.-Q.C Named Option – 16 credits</td>
</tr>
<tr>
<td><strong>Minimum Graduate Coursework (50%) Requirement</strong></td>
<td>M.A. – Half of degree coursework (15 out of 30 total credits) must be completed in courses numbered 700 or higher. M.S. – Half of degree coursework (15 out of 30 total credits) must be completed in courses numbered 700 or higher. M.S.-Q.C. Named Option – Half of degree coursework (15 out of 30 total credits) must be completed in courses designated for graduate credit (see course guide).</td>
</tr>
<tr>
<td><strong>Prior Coursework Requirements: Graduate Work from Other Institutions</strong></td>
<td>With program approval, students are allowed to count no more than 9 credits of graduate course work from other institutions. Course work earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.</td>
</tr>
<tr>
<td><strong>Prior Coursework Requirements: UW-Madison Undergraduate</strong></td>
<td>With program approval, students are allowed to count no more than 9 credits of graduate course work from UW-Madison. Course work earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.</td>
</tr>
<tr>
<td><strong>Prior Coursework Requirement: UW-Madison University Special</strong></td>
<td>With program approval and payment of the difference in tuition (between special and graduate tuition), students are allowed to count no more than 9 credits of course work numbered 500 or above taken as a UW-Madison University Special students. Course work earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.</td>
</tr>
<tr>
<td><strong>Credits per Term Allowed</strong></td>
<td>M.A. – 15 credits, M.S. – 15 credits M.S.-Q.C. Named Option – 15 credits</td>
</tr>
</tbody>
</table>
Attachment 5.1

Assessment Plan

Identifying Information
School/College: Letters and Science
Graduate Degree/Major Program Name: Master of Science in Physics – Quantum Computing
Graduate Degree Level (M.S., M.A., Ph.D., DMA, etc.): M.S. (Named Option)
Faculty Director Contact/Title: Prof. R. Joynt
Primary Contact Information: rjjoynt@wisc.edu

1. Masters the physical and mathematical concepts of quantum computing (quantum mechanics, statistical mechanics, quantum algorithms, quantum information).
2. Articulates, critiques, or elaborates the theories, research methods, and technologies of quantum computing.
3. Identifies sources and assembles evidence pertaining to questions or challenges in quantum computing, both the physical basis and the computational results.
4. Demonstrates understanding of quantum computing in an historical, social, or global context.
5. Selects and/or utilizes the most appropriate methodologies and practices.
6. Evaluates or synthesizes information pertaining to questions or challenges in quantum computing, both at the basic physics level and at the level of applications.
7. Communicates clearly in ways appropriate to the field of quantum computing.
8. Recognizes and applies principles of ethical and professional conduct.
### Plan for Assessing Each Student Learning Outcome

The MS-P-QC program is an intensive one-year program focused on classroom learning. This implies that the majority of the assessment methods are conventional and well-established. There are 8 learning goals, which requires two tables for readability.

<table>
<thead>
<tr>
<th>Assessment Planning Outcomes 1-4</th>
<th>1. Masters the physical and mathematical concepts of quantum computing (quantum mechanics, statistical mechanics, quantum algorithms and quantum information).</th>
<th>2. Articulates, critiques or elaborates the theories, research methods and technologies of quantum computing.</th>
<th>3. Identifies sources and assembles evidence pertaining to questions or challenges in quantum computing, both the physical basis and the computational results</th>
<th>4. Demonstrates understanding of quantum computing in a historical, social, or global context.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct methods for assessing learning</td>
<td>Conventional grade-based assessment on homework and exams</td>
<td>Performance on term paper or research paper</td>
<td>Performance on term paper or research paper</td>
<td>Conventional grade-based assessment on homework and exams</td>
</tr>
<tr>
<td>Direct methods for assessing learning</td>
<td>Conventional grade-based assessment on instructional laboratory experiments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indirect methods for assessing learning</td>
<td>Classroom participation</td>
<td>Consultation with faculty on research or advanced topic or experiments</td>
<td>Consultation with faculty on research or advanced topic or experiments</td>
<td>Consultation with faculty on research or advanced topic or experiments</td>
</tr>
<tr>
<td>Indirect methods for assessing learning</td>
<td>Comparison to undergraduate and PhD students in similar or comparable classes</td>
<td>Discussion of Instructional lab experiments</td>
<td></td>
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<tr>
<td>Assessment Planning Outcomes 5-8</td>
<td>5. Selects or utilizes the most appropriate methodologies or practices</td>
<td>6. Evaluates or synthesizes the information pertaining to question or challenges in quantum computing, both at the basic physics level and at the level of applications.</td>
<td>7. Communicates clearly in ways appropriate to the field of quantum computing</td>
<td>8. Recognizes and applies principles of ethical and professional conduct.</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Direct methods for assessing learning</td>
<td>Conventional grade-based assessment on homework and exams</td>
<td>Performance on term paper or research paper</td>
<td>Performance on term paper or research paper</td>
<td>Performance on term paper or research paper</td>
</tr>
<tr>
<td>Direct methods for assessing learning</td>
<td>Conventional grade-based assessment of instructional lab work</td>
<td>Examination of laboratory notebooks</td>
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</tr>
<tr>
<td>Indirect methods for assessing learning</td>
<td>Comparison to undergraduate and PhD students in similar or comparable classes</td>
<td>Consultation with faculty on research or advanced topic or experiments</td>
<td>Consultation with faculty on research or advanced topic or experiments</td>
<td>Consultation with faculty on research or advanced topic or experiments</td>
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<tr>
<td>Indirect methods for assessing learning</td>
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<td></td>
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</tbody>
</table>
Logistical Questions

1. **Who is responsible for assessment?**
   There is a specific faculty committee made up of 3-4 members that oversees the new Master’s named option program. This is called the QC committee. It is chaired by the director of the Master’s named option program, who also appoints the committee members under consultation with the Chair of the Physics Department. They will coordinate the implementation of the assessment plan on an annual basis. In particular, they will compile and analyze all student learning assessment data. This committee will report to the Graduate Program committee, which is chaired by the Associate Department chair for the Graduate Program, currently Prof. Alex Levchenko. The Graduate Program committee is responsible for the oversight of the whole graduate program, including all MS, MA, and PhD degrees. They will have final responsibility for evaluation of the data and communicating it to the Department Chair.

2. **What is the plan for review of the assessment information?**
   Assessment data from the academic year will be compiled in the following summer by individual QC committee members assigned to the task by the chair. The QC committee will meet annually in September. At this meeting the assessment data from the previous academic year will be analyzed. It is also expected that a more general review of the program, including enrollment and logistical questions will be carried out at this meeting. The review of the resulting report will be carried out by the Graduate Program committee, also early in the Fall semester. The full Faculty of the department meets regularly, about every two weeks during the semester. At a meeting in September or October at a precise date chosen at the discretion of the department chair, the department will review the report of the QC faculty committee. This will include a full evaluation of the MS named option program in addition to the student learning assessment. It will also include recommendations for changes in the program, if necessary.

3. **What is the plan for production of an annual summary report?**
   After receiving the input both from the Graduate Program committee and from the full faculty, the QC committee will prepare the final report, which must receive final approval from the Department chair. Again, this may contain action recommendations as well as assessment and review. The Department Chair will have the responsibility to communicate the final report to the Office of the Provost by November 1.

4. **How will recommendations be implemented?**
   According to the above timeline, actionable items will have been discussed and decided upon by the various departmental bodies by November 1 of each year. Relatively minor curricular changes will be implemented starting in the following Spring semester, if necessary. More major reorganizations will normally be implemented starting in the following Fall semester. The only exceptions for which a longer timeline would be appropriate would be those for which new laboratory experiments much are deemed necessary. The department will monitor all new implementations annually, with a more comprehensive report being compiled during the appropriate student learning outcome assessment year (within the 3-year timeline).
### Graduate Degree Program Curriculum Map

#### Curriculum Map (I)

<table>
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<tr>
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<th>Learning Outcome #1</th>
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<th>Learning Outcome #3</th>
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<tr>
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<td>PHYS 799</td>
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<td>PHYS 707</td>
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<tr>
<td>Electives</td>
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#### Curriculum Map (II)

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<td>PHYS 579</td>
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<td>PHYS 531 or PHYS 731</td>
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<td>Electives</td>
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## Annual Fiscal Summary for Physics MS Named Option

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<th>YEAR 2</th>
<th>YEAR 3</th>
<th>YEAR 4</th>
<th>YEAR 5</th>
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<tr>
<td><strong>PROJECTED REVENUE:</strong></td>
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</tr>
<tr>
<td>Total Tuition for academic year (Fall+Spring+Summer semesters)</td>
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<td>48,000</td>
<td>48,000</td>
<td>48,000</td>
<td>48,000</td>
</tr>
<tr>
<td>Projected total revenue from the program for the upcoming academic year. # of students * cost of tuition or cost per credit taken (as established for the program) Please fill in tuition and # of students for information purposes.</td>
<td>$480,000</td>
<td>$960,000</td>
<td>$1,200,000</td>
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<tr>
<td>LESS: Revenue sharing:</td>
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<tr>
<td>Campus and L&amp;S Tax is figured on the amount of total revenue. Percentage provided is an estimate of what the tax will be next fiscal year.</td>
<td>$159,984</td>
<td>$319,968</td>
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<td>Projected Revenue to Department</td>
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<td>$640,032</td>
<td>$800,040</td>
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<tr>
<th></th>
<th>YEAR 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
<th>YEAR 4</th>
<th>YEAR 5</th>
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<td><strong>PROJECTED EXPENSES:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>List faculty and staff who will be paid partially or in full on 131 funds for administrative service in the program or who have been hired on 131 funds to teach in the program. Estimate fringe using the current RSP rate for planning purposes.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Faculty: 1 month summer salary for Program Director</td>
<td>$17,778</td>
<td>$18,133</td>
<td>$18,496</td>
<td>$18,866</td>
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<td>Actual Fringe (substitute RSP rate for planning)</td>
<td>$6,222</td>
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<td>Academic Staff: 4.5 courses at lecturer rate, 3 new, 1.5 expanded</td>
<td>$120,000</td>
<td>$122,400</td>
<td>$124,848</td>
<td>$127,345</td>
<td>$129,892</td>
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<td>$42,840</td>
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<td>University Staff Lines: Program Administrator (1/2 time)</td>
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<td>Name/position/FTE/salary</td>
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<td>Actual Fringe (substitute RSP rate for planning)</td>
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<td>Graduate Assistants:</td>
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<tr>
<td>PROJECTED DEPARTMENT NET REVENUE:</td>
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<td>$365,298</td>
<td>$519,585</td>
<td>$514,812</td>
<td>$509,944</td>
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1. New and Additional Student Enrollments to Support Program Costs

- The program must bring in NEW and ADDITIONAL students. Overall enrollment in all other school/college programs must not be eroded. The program cannot compete with or draw students away from existing programs that support the central tuition pool.

- Faculty/staff must plan for sufficient enrollments to have enough tuition to cover instructional, direct student support costs, and any other fixed or required costs. Experience shows that enrollments of at least 30 students are necessary to have enough tuition to meet direct program costs.

- School/college Budget Officers must be involved in planning and must approve plans and budgets for these programs before the program is submitted to the school/college APC for academic approval.

2. Designed for Non-Traditional Students

- Has an applied, practice-oriented curriculum, or integrates practice with theory

- Is offered in a modality that allows non-traditional audiences to attend (evening, weekend, online, intensive, or some combination)

- Has demonstrated a workforce demand for the program graduates

- Has defined learning goals that are oriented to market considerations

- Has a clearly defined curriculum that is “self-contained”, meaning that program students are confined only to courses from the approved, prescribed curriculum

- Has a clearly defined (often lockstep) curriculum with few options or electives that follows a predictable timeline for offerings and completion

3. Distinctly Identifiable Program (Code) With Governance Approval

- The program must be distinctly identifiable in the student record system, either as a degree/major or as an option of a degree/major, or as a Capstone certificate.

- The program must develop a proposal for the academic approval process, during which it must demonstrate that the school/college Dean and Budget Officer are aware and supportive of the program being run on a non-pooled tuition model.
1. Fiscal Requirements:
   ✓ School/college budget officer has approved the budget and fiscal plan.
   ✓ School/college dean and budget officer are committed to assuming fiscal responsibility for costs not covered by non-pooled tuition to the program. The school/college will back up the budget with a commitment to cover any costs not met from tuition from other sources.
   ✓ The program structure fits within standard academic administrative structures and allocates expenses of the program so that the program does not create additional burdens on traditional/101 program resources or student services such as advising, ESL, Registrar’s Office, Bursar’s Office, Graduate School and other support services.
   ✓ Programs have two options for tuition. One option is to charge standard graduate tuition according to the UW-Madison tuition schedule. This includes standard rates for WI resident, MN, and non-resident students and any compulsory fees that apply. Or, for fully online programs, they have the option of charging all students one of tuition tiers (Appendix D). Although not currently allowed, it is potentially possible in the future the tiered tuition may be available to face-to-face programs. We charge a tier tuition and seek a waiver to do so.
   ✓ Because students who have graduate assistantships receive tuition waivers, some non-pooled tuition graduate degree programs choose to prohibit students from accepting a graduate assistantship (RA/TA/PA). If a program allows their students to take graduate assistantships they it must forgo the tuition revenue. To ensure full receipt of non-pooled tuition and to counter challenges from students, the program must adhere to the following:
     ✓ The program faculty/staff must disclose this program policy to students in the recommendation of admission letter, program website, program handbook, and program orientation.
     ✓ Please see Appendix E for links and Appendix F for a sample of a specific non-pooled program template for a recommendation of admission letter and a general template for a program handbook. The program faculty/staff must provide details on this and any other program policies the program handbook in at least the following areas: satisfactory progress (good standing) requirements, any ways to return to good standing, and a program grievance process if done does not already exist.

2. Requirements for International Students:
   ✓ Programs may not admit students who need ESL services without building sufficient ESL support into their fiscal model, and having an explicit MOU with the ESL provider about funding to support the ESL services.
   ✓ Graduate degree/major programs must use Graduate School standards for English Proficiency. Capstone certificates should be designed so that admission requirements ensure that ESL support is not needed.
If the program is NOT completely online and admits international students, the program is responsible for honoring federal visa regulations related but not limited to: length of stay requirements for visa requests, online course restrictions for visa holders, and waiting for federal program approval (up to a year) if the program represents a new degree type or capstone certificate previously not offered at UW-Madison.

3. Requirements for Program/Course Enrollment:

- Non-pooled tuition program students can only be enrolled in one program at a time; enrollment in a second major, named option, certificate program, or courses beyond the prescribed program curriculum is not permitted. Non-compliance with this requirement will jeopardize the receipt of tuition for a non-pooled program. Regular audits will be conducted to ensure these requirements are met.

- To ensure full receipt of non-pooled program tuition and to counter challenges from students who want to be dually enrolled, the program must adhere to the following:
  - The program must provide information to students about prohibitions on concurrent program enrollment and out-of-program course enrollment. Programs must note this in recruiting materials, in recommendations of admission, on the program website, program handbook, and program orientation.
  - Please see Appendix E for links and Appendix F for language for a specific non-pooled program template for a recommendation of admission letter and a general template for a program handbook. The program faculty/staff must provide details on this and any other program policies in the program handbook in at least following areas: satisfactory progress (good standing) requirements, ways to return to good standing, and a program grievance process if one does not already exist.
  - The program communicates to students each semester prior to course enrollment the expectation that students can enroll only in program courses and not in courses outside the approved, prescribed curriculum.
  - For students who enroll in the non-pooled program and then decide they want to pursue traditional/101 programs that allow dual enrollment, the program must help the student transfer to a different program(s) that allow such activity.
March 16, 2018

Prof. Sridhara Rao Dasu  
Chair, Department of Physics

As Chair of the Computer Sciences (CS) Department, I write to express support for the proposed Master of Science in Physics, Option: Quantum Computing degree. Quantum computing is a promising future technology which has seen some interesting developments recently and many companies and researchers are actively pursuing this technology. The proposed degree should provide a good understanding of the physics of quantum computing technology. Since there are currently no CS courses involved, there is no additional demand placed on the CS department at this time. As quantum computing involves, and new computing hardware and software technologies are developed, I expect courses to be developed in CS to cover these matters. When that happens, I expect CS may also have an interest, perhaps in partnership with the Department of Physics, to develop a degree program tailored towards quantum computing technology.

Sincerely,

Gurindar S. Sohi  
Department Chair  
Vilas Research Professor
Dear Eric,

Thank you for asking for our input on the proposal to introduce a named option in Quantum Computing into the Master of Science degree program in the Department of Physics. This is an important and emerging field and the College of Engineering supports the formation of this named option. We look forward to working with and supporting our colleagues in Physics on this new opportunity.

Yours sincerely,

[Signature]

Ian M. Robertson
Dean, College of Engineering
This memo is to request that Professor Jan Edwards be awarded an extension of her graduate faculty status for an additional academic year. The Executive Committee of the Department of Communication Sciences and Disorders voted unanimously in favor of this (7 of 7 votes) on April 26, 2018.

Professor Edwards resigned her position as Professor of Communication Sciences and Disorders in 6/2016 to accept an outside offer at the University of Maryland. She was a valued colleague and contributor in our department for 11 years prior to that. Our request to extend her faculty status is so that she can serve as an internal committee member on the doctoral dissertation committees of two graduate students in our department. She has been closely involved with both students throughout their graduate work at Wisconsin and has remained actively involved since her departure from the university. These students would experience undue hardship if they were required to find a new committee member at this late date. Both intend to defend this summer or early fall.

Thank you for considering this request.
Dear Dean Karpus,

Following your letter of February 15, our director of graduate studies has formed an ad-hoc committee to discuss admissions, advising, and exam policies in the Department of Mathematics. There was broad participation of faculty in this committee, including most members of the Graduate Program Committee. We also solicited and received input from various graduate students, including but not limited to student members of the Graduate Program Committee.

The ad-hoc committee initially focused on early graduate academic advising in the Department, for students who do not have found a dissertation advisor yet. The committee discussed other topics such as ways to speed up the choice of dissertation advisors, the general objectives of our preliminary exams (in particular the written qualifying exams), various exam and grading policies, and the make-up and goals of the preparatory summer enhancement programs.

The committee identified areas where improvements could be made. These include sessions to educate academic advisors, and possible changes in exam policies. We have introduced some changes effective immediately, by introducing a training session for academic advisors, and by facilitating the students’ study for the exams. We are currently working on some revisions of our qualifying exam policies. Some suggestions discussed on the committee may be more controversial and require further consideration. The Graduate Program Committee will continue the discussion in 2018-2019.

The ad-hoc committee was also in charge to look into the admissions policies of the department. However since the 2018-2019 chair of the admission committee, Tullia Dymarz, is currently on sabbatical, the committee decided to postpone an in depth discussion to the fall. Independently of the committee, some faculty together with graduate students organized various new recruitment activities for admitted female graduate students. We shall have an unusually large class of 36 incoming students in the fall, including 10 women.

In 2018-2019 the chair will form a committee in charge of recruiting students for our VISP programs and the Masters program Foundation of Advanced Studies. This will expand the participation of faculty in the recruitment process. It will take a couple of years for the program to diverse and not just depend on one person.
Sincerely,

Tonghai Yang
Professor and Chair
April 26, 2018

To:  Sarah Mangelsdorf, Provost
     William Karpus, Dean of the Graduate School

From: Richard Straub, Senior Associate Dean, CALS

Re: Department of Agricultural and Applied Economics Program Reviews

Cc: Nikki Bollig, Dominique Brossard, Jeremy Foltz, Sarah Kuba, Jocelyn Milner, Parmesh Ramanathan

On April 17th, the CALS Academic Planning Council reviewed and voted to accept as complete the review of the academic programs in the Department of Agricultural and Applied Economics. The self-study was completed in the summer of 2017, and the review team’s report was submitted in March 2018, with the department response completed in early April. Copies of the latter two documents are attached, and additional documents are on file in the college and available on request.

The review covered the following programs:
- Agricultural & Applied Economics, BS, MS, PhD, Doctoral Minor (10-year review)
- Agricultural Business Management, BS (10-year review)
- Undergraduate Certificate in Development Economics (5-year review)
- Undergraduate Certificate in Business Management for Agricultural and Life Sciences (5-year review; joint program with Department of Life Sciences Communication)

In addition, although the MS named option in Resource and Energy Demand Analysis (REDA) is not yet due for its 5-year review, the CALS deans asked the department to discuss the status of that 131 program in their self-study. (Note that the PhD in Development, which is administered by the AAE department, completed its last review in June of 2017 and was not considered further in the present review.) As in all CALS program reviews, we ask departments not only to address the status of the academic programs themselves, but also to provide “a concise overview of other aspects of the department, including the faculty, facilities, and research and Extension/outreach missions…emphasizing not only how they affect and intersect with the academic programs under consideration, but also how they impact the overall strength of the department.”

The review committee chair noted the complexity of the review resulting from the number of programs under consideration, but the overall state of the department and its programs is excellent. The review committee noted as particular strengths of the department’s academic offerings the growth in undergraduate enrollments and CFI, the strategic assessment of learning conducted across the programs, and the positive climate and good placement results described by students.

The committee noted several challenges being faced by these programs, most of which are not unique to this department.
• **Desire for more faculty, especially in specific sub-disciplinary areas (e.g., trade, applied econometrics).** Much of AAE’s hiring in recent years has been through opportunistic hiring, which has enabled their faculty numbers to remain more stable than most departments in the college, but has constrained the areas in which they have been able to hire. Given current hiring patterns and projections in the college, this situation is unlikely to change significantly in the near future. The department’s successful engagement in 131 programs has the potential provide them some future hiring flexibility if these programs can bring sufficient revenue to support additional faculty lines.

• **Climate between ABM and AAE undergraduates.** The review committee found some evidence to suggest that tensions exist between undergraduates in the ABM program and those in the AAE program, and there is some anecdotal data that these may result in part from differences in the demographics and life experiences of the two groups. The APC recommended that the department investigate the root causes of this concern and ways to continue to improve climate for all students.

• **Undergraduate time-to-degree is > 4 years for ABM.** The college’s average time-to-degree across all undergraduate programs is 3.9 years. The average in AAE is 3.85 but in ABM is 4.09, above the average of 3.98 for AAU peers. We encourage the department to look into the situation for ABM students in more detail to determine whether curricular or structural changes might help bring time-to-degree closer to or below 4.0 years.

• **Access to faculty mentorship/advising for undergrads.** In the undergraduate programs, the department has opted to rely significantly on an academic staff advisor rather than faculty advisors (a not uncommon pattern in recent years in CALS, and fairly typical of programs elsewhere on campus). A benefit of this arrangement is the consistency of the content and availability of advising, but a downside is the limited faculty engagement with and mentorship of undergraduates. We encourage the department to participate in college-wide discussions that are underway to strengthen undergraduate advising (in part through partnerships that cross department boundaries) and also to seek ways for faculty to continue to work closely with students so students can benefit from the expertise of both academic staff and faculty.

• **Lack of racial/ethnic diversity across programs.** Like many departments, AAE has struggled to see significant improvements in racial and ethnic diversity in its faculty and graduate student populations. We recommend working with the Equity and Diversity Committee through your diversity department representative, Dan Phaneuf, to develop strategies for recruitment and outreach.

In short, the academic programs are generally well-functioning, but the department personnel are spread thin, more by the number of programs being managed than by the combined enrollments across all the programs. We encourage the department to continue to work toward articulating how the programs they offer come together in a coherent whole that draws on the strengths of the department faculty rather than existing as a diffuse set of discrete activities. In addition, it will be important for the department and the deans to pay close attention to the 131 programs of the department (current and planned) to ensure that department and college human and financial resources are being wisely deployed and well leveraged.
Dear CALS Deans and APC,

The department of Agricultural & Applied Economics has read through the report of the 10-year review committee. We have a number of minor factual corrections, some added data to address questions that came up in the APC meeting, and reactions that show how we plan to respond to the recommendations of the review committee.

We have the following factual corrections. These corrections are important in that they go to issues brought up in the recommendations.

1) In item 3d “climate” and “changing demographics” says that the number of AAE majors is declining relative to ABM majors. This is not true.

2) Also in 3d and in the recommendations the assumption is that AAE majors are “students who come from farm communities” and focused on farming and agriculture, while the ABM are business students from non-rural areas. This is not the case. Our students focused on farming end up majoring in both AAE and ABM. Students from rural areas are about equally represented in each of our majors.

3) In item 4c we’re said to be “getting involved with GERS and other campus programs”. The department has had a member of the Sci-Med GRS advisory committee since its inception a decade ago.

4) In 3) Undergraduate Program, c) Growth and Success, the committee left out the field of environmental economics. In the second paragraph of c) Growth and Success, they have incorrect names for our 2 certificates. The correct names are Business Management for Ag & Life Sciences and Development Economics.

We are attaching below a number of data sheets from the university websites to provide better information on some of the questions that the APC had in the first reading of our 10 year review.

In terms of suggestions for the department, we have the following reactions the recommendations made by the committee.
a) Hiring new faculty: the committee finds that AAE will need to hire more faculty members to meet the demands of continued growth in enrolling more majors and serving more students from across campus.

We are in strong agreement with this suggestion. CALS and past APC demands that we hire production agriculture faculty has hampered AAE’s ability to be a top research and teaching department and is inconsistent with the campus level drive for more undergraduates and high indirect cost grants. We hope that the new CALS budget planning will give AAE more flexibility to choose faculty hires that can address our needs.

b) We recommend the department pay deliberate attention to the distinctions some students feel between those enrolled in ABM and those in AAE. We recommend the department comes up with a predetermined strategy to address this aspect of the departmental climate. There is an opportunity to enrich both "groups" of students through constructive engagement.

We will work with faculty in key courses to improve the cross-major socialization.

c) We also recommend the department start developing a strategy for dealing with the demographic shift of the student population: less students from rural and agricultural populations and more interest in agricultural business. This shift might be an opportunity, but it requires strategic rethinking of the undergraduate program: its certificates, majors, and courses.

We will work to develop a strategy for the coming demographic shift. That strategy will seek to provide new learning opportunities for this new population.

d) Advising: we recommend that more faculty advising be available to students. A strategy that has been successfully implemented in other departments is to have an administrative advisor responsible for the technical requirements of the program while at the same time having a faculty advisor who can be a resource for thinking about life questions that are relevant to disciplinary interests.

We have just conducted a survey or our soon to be Spring 2018 graduates and identified some issues and places for improvement in our advising policy. We will be implementing them in the near future.

e) Diversity: the committee was impressed with the department’s accomplishment in filling the gender gap and in diversifying the community by recruiting many international students, especially those from Africa. We also understand the difficulties inherent in trying to reduce the racial gap. However, the committee feels that more deliberate effort needs to be made and that more can be done in this domain. We think a predetermined and thought-out strategy for covering recruiting targeted minorities should be developed and that resources should be given to that effort. We also call on CALS to increase the resources available for such efforts.
Our investigation of the data shows that our graduating class in the last 3 years has had 10 – 11% targeted minorities (see attached data sheets). This is better that the 9% average overall at UW-Madison, 9% in CALS, and the 4 – 8% level in Economics. We are thus doing much better than we, or the review committee had thought. We will nonetheless continue our efforts to increase our targeted minority population.

We appreciate all the hard work of the review committee, CALS Deans, and CALS APC to analyze and make recommendations to improve our department.

Sincerely,

Jeremy Foltz
Professor and Chair
Review Committee: Samer Alatout (Chair), Kenneth Albrecht, Robert Anex, Mike Graham (GFEC Representative)

1) Review Process
The committee was charged by CALS Senior Associate Dean Richard Straub to review the Academic programs of the Department of Agricultural and Applied Economics (AAE). AAE provided a self-study for this review. The committee reviewed the self-study, the previous external review of 2006, the different pages of the AAE website, and additional information prepared by the Graduate School. AAE also responded to a questionnaire of 50+ questions that was prepared by the review committee. The review committee held two meetings to discuss the review process and met with the Chair, DGS, faculty members, administrative staff, graduate students, and undergraduate students. The committee’s comments below come at the conclusion of this review process.

2) Executive Summary
Since the external departmental review in 2006, the Department of Agricultural and Applied Economics succeeded in building its undergraduate program in terms of the number of undergraduate students it serves, better defining its curriculum, and enhancing its student learning goals and objectives. In particular, AAE successfully increased the undergraduate student body that it is serving, and as of 2016/17, AAE is serving 250 students as majors (137, up from 82 ten years ago) and as certificate students (113). Equally impressive is the seriousness with which AAE deals with assessing students’ academic achievements: streamlining of the curriculum and creatively inserting embedded assessment questions in tests for multiple courses, on the undergraduate and graduate levels. Undergraduate time to completion was reduced, and the students successfully compete for relevant jobs. The department also increased its offering, adding two certificates, and increasing enrollment in many of the courses offered (five courses enroll more than 100 students and one course has an enrollment of 250+). The graduate program (PhD and PhD Minor, two master degrees and one professional master) continues its successes. For example, the number of graduate students increased since last review in 2006 from 50 to 70 and the PhD completion time was reduced from 5.7 to 5.3 years. The main hurdles facing the department and its plans for growth are staffing, especially in terms of flexible faculty hires, and the changing student demographics on the undergraduate level.

3) Undergraduate Program
a) Overview
AAE offers multiple programs that serve many student needs, from undergraduates (with two undergraduate majors and two undergraduate certificates), a PhD and a Doctoral Minor, two MS programs, and a professional MS program in Resource and Energy Demand Analysis, REDA. The department’s offerings contribute to UW’s and CALS’

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1 Note that this review concerns the seven programs run by AAE, including: undergraduate majors AAE and Agricultural Business Management (ABM), AAE MS, PhD in AAE, PhD in AAE Minor, Certificate in Development Economics (5-year review), Certificate in Business Management for Agricultural and Life Sciences (5-year review).
excellence in agricultural business management, the economics of international
development, environmental and resource economics, and community development
economics. In all of these dimensions, the department distinguishes itself by its applied
approach to economics. The department offers a number of large-enrollment introductory
classes (three are near 100 students and one has enrollment over 280 students). There are
also small classes for advanced undergraduates, and capstone classes aimed at
encouraging students to integrate the knowledge they acquire through their undergraduate
careers in comprehensive projects.

b) Analysis of the Program
AAE is a central component of the social science scene offerings within CALS,
especially by providing an economic foundation for understanding agricultural business
and international development. AAE undergraduate programs provide introductory
understanding of the economics of agricultural business and community development to
students within the department, in CALS more generally, and throughout campus.

c) Growth and Success
Faculty members constitute the main strength of the department with their active research
and teaching in diverse areas of the field: development economics, agricultural applied
economics, and agricultural business economics. In all of these areas, they contribute
heavily in terms of research (a look at the citation patterns reflects a very positive effect
of the impact of their research) and instruction (as evidenced by their active teaching
profiles). The department actively and successfully runs multiple programs on the
undergraduate level including two majors (AAE and ABM) and two certificates
(Development Economics and Business Management for Agricultural and Life Sciences).

The AAE undergraduate program’s growth is impressive in a number of ways. The
number of undergraduate students enrolled in both majors grew since the last external
review of 2006 from 82 to 119-137 (depending on the semester and the number of
graduating seniors) students. In addition, the department has been running two
undergraduate certificates, Agricultural Business Management and International
Development Economics that between them serve 101 students (fall 2017). In addition,
the department has been serving an ever-larger body of undergraduates in the department,
the college and on campus. AAE has been teaching a number of large undergraduate
courses (with three courses near 100 students and one course more than 280). All of this
led to an impressive increase in CFI (credit follows instructor) where in 2016/17 the
department had 5,586 in CFI, an increase of 15% over 2012-13. Relative to FTEs, this
means 294 CFI per faculty, an increase of 33% during the same period. Compared to the
rest of CALS, AAE represents 7.3% of the number of faculty and 8.5% of CALS total
CFI.

The department succeeded in setting goals and learning objectives for undergraduate
programs. In addition, the department also developed strategies to assess the degree to
which the programs meet those goals. In part, that has been done through senior capstone
courses in which the students complete projects and presentations with a predetermined
rubric. Assessment is also done through embedded questions and pre- and post-testing in core courses: AAE 215 and 421.

The average time to completion for undergraduates in AAE is 4.33 and for ABM is 4.27. With the new restructuring of requirements and programs, the hope is that students (other than transfers) will be able to complete their degrees in 4 years.

From the department’s self-study report and from conversations with the undergraduate students, it seems that most of the students find work in their field at graduation.

d) Challenges and Needs
Faculty recruitment: the main challenge faced by the department’s growth is probably the number of faculty serving an increasing number of students. While the department has been very successful in hiring new faculty members to teach environment and resource economics, it has not been allowed to hire for an open position in the last ten years. One of the priorities the department has set for itself is hiring a faculty member whose specialty is trade, but other possible hires include experts in econometrics.

Climate: while the collegial atmosphere in the department should be acknowledged and appreciated, there seems to be a distinction and low-level tension in the undergraduate program between students enrolled in ABM (many coming with business interests and after trying for the Business School) and those who enroll in AAE (students who come from farming communities).

Changing demographics: the department's demographics are changing and that might cause difficulty in the coming decade. The number of AAE students, those presumably focused on farming and agriculture, has been decreasing as a percentage of those majoring in the department. This might pose a future problem for both the AAE major and the AAE certificate.

Time to completion: time to completion for undergraduate students is more than four years for both majors (4.33 for AAE and 4.27 for ABM).

Advising: there is only one advisor for undergraduate students and that cannot be sufficient for a program of this size. In addition, the advisor is administrative, which means there are very limited chances of the students to interact with faculty members outside their courses. The students seem to suggest that is a problem.

Diversity: While there is something to be celebrated in the department’s success filling some of the gender gap by hiring a number of women faculty members and increasing women’s participation in the undergraduate and graduate programs, the lack of diversity of targeted minorities is still a problem. Diversity in the undergraduate and graduate student body, as well as in faculty, needs to be addressed.
4) Graduate Program

a) Overview

The PhD program in Agricultural and Applied Economics enrolls about 12 students per year and the MS program about 5. These enrollments have been stable over the past several years. The program assesses itself to be roughly in the top five in the country, with peers being UC-Berkeley, UC-Davis, U of Maryland, and Cornell. They generally lose admitted students to Berkeley. The department has four research thrusts: environmental and resource economics, economics of agriculture, development economics and community economic development. The department has an integrative emphasis that they find is attractive to many students – they really bring together economic theory and practice. A relevant point is their relation to the Economics department: the department writes “There is a big difference in departmental missions and philosophy between the Economics department and the Agricultural and Applied Economics department. In AAE we seek to apply economic theory and tools to answer real world applied problems. Typically we work from the problem to the theory and produce empirical research that almost always has relevant policy implications. The Econ department has a more theoretical tradition, which is about developing the tools that can be used in economic analysis. In this sense combining the departments would be like combining physics and engineering: they are both physical sciences, but one would not think they do the same thing…. We do not offer the 6 subfields they offer (Micro, Macro, Econometrics, Labor, Trade, Public) and they do not offer the 4 subfields we offer…. In AAE we also perform an important function in doing the applied economics outreach for UW-Extension, which is also a function unlikely to be done by the Economics department.” That said, the PhD students are competing in the same academic job market as the straight Econ students.

b) Curriculum, evaluation and student support

About 90% of students are admitted with 4 years of guaranteed funding (and almost always receiving 5). Mostly RAs, some TA support – REDA program helps with this – there is some TA support through that program. Other admitted students have support from their home country.

The graduate students we talked to had been supported by multiple mechanisms over their tenure in the program: USDA, Hatch Grants, TAs. They were comfortable with this situation. Funding is available in the department and university for conference participation. Students are not admitted to work with a specific advisor. They are assigned an advisor upon admission but this is not necessarily their ultimate advisor – about 50% of students will change advisors.

A distinguishing feature of this program relative to other AAE programs is that, in addition to courses within the department, graduate students are required to take two core graduate Econ courses. These are rigorous and mathematical. The department runs a “boot camp” to help students be mathematically prepared for the core graduate Econ classes. Students who get a B or better do not have to take the microeconomics prelim. There is also a “field prelim” in which students have a week to answer questions posed by the faculty. In recent years all students have passed the prelim. Students are expected
to defend a thesis proposal at the end of the third year – most third year students take a seminar course to aid in developing their proposal. There are consequences such as registration holds and potentially loss of funding if they do not present the proposal in a timely manner.

There is no formal annual feedback mechanism but there is regular interaction with the advisor and committee, largely through student seminars held in the various thrust areas of the department. The students we spoke with felt that expectations for graduation were clear: the rule of thumb is three papers, not necessarily published.

c) Demographics
PhD students in the department are about 65% male, 50% nontargeted minority, and single-digit percentages for targeted minority populations. The MA program has very little enrollment. The MS program, which draws 5 or so students per year has interesting demographics – 50/50 m/f rather than 65/35. The department is well aware of the low numbers of URM students. They have very few applicants from these populations. The department is making a point to work with under-represented minorities (URM) undergraduates to help develop the graduate student pipeline for the field. (Hopefully other universities are doing the same.) They are also getting involved with GERS and other campus programs. As an example of the challenge they face, a department representative went to the McNair Scholars career fair and were not approached by a single student.

Average residence time in the PhD program is similar to peers. However, data from the graduate school shows a long tail in the distribution: 34% > 6 years, 12%>8. This issue deserves follow-up.

d) Student experience
The students who spoke with us were comfortable with the department climate. They have a graduate representative that occasionally attends faculty meetings. They have been able to bring up issues of interest such as a desire for certain courses and increased travel funding. The woman graduate student we talked to did note that she had experienced some form of gender bias or inappropriate behavior from a faculty member, but not in this department. She did not wish to elaborate.

Students felt that expectations were clear and that they had ample opportunities for feedback from faculty, especially through the seminars, at which they give presentations once or twice a semester. There is also an informal student colloquium series that allows for peer feedback. The handbook appears to be very thorough and the students felt it was satisfactory. They also commented that the graduate administrator sends reminders of what to do when.

The department shared results of an exit survey of PhD grads from 2012-2016 that revealed very positive views of the department. Only 50% of students reported a formal annual assessment of progress. Otherwise all looked well. There were no red flags.
PhD students from this program have a very high job placement rate. Many students are in academia, at both undergraduate institutions and research universities. Other students find positions in government, companies and NGOs. The plurality of students responding to the exit survey had positions in Washington, DC.

e) Challenges
Research support in AAE is not growing so neither can their student numbers. The faculty expressed an interest in strengthening faculty/student interactions. The department would like to hire a faculty member with expertise in applied econometrics—this is a core methods area that doesn’t get traction in activities like cluster hires.

5) Recommendations
The department and its graduate and undergraduate programs are functioning well. We see the following recommendations as important for the continued success of the department and for keeping up with the changing landscape of the department’s constituencies and higher education in general.

a) Hiring new faculty: the committee finds that AAE will need to hire more faculty members to meet the demands of continued growth in enrolling more majors and serving more students from across campus.

b) We recommend the department pay deliberate attention to the distinctions some students feel between those enrolled in ABM and those in AAE. We recommend the department comes up with a predetermined strategy to address this aspect of the departmental climate. There is an opportunity to enrich both "groups" of students through constructive engagement.

c) We also recommend the department start developing a strategy for dealing with the demographic shift of the student population: less students from rural and agricultural populations and more interest in agricultural business. This shift might be an opportunity, but it requires strategic rethinking of the undergraduate program: its certificates, majors, and courses.

d) Advising: we recommend that more faculty advising be available to students. A strategy that has been successfully implemented in other departments is to have an administrative advisor responsible for the technical requirements of the program while at the same time having a faculty advisor who can be a resource for thinking about life questions that are relevant to disciplinary interests.

e) Diversity: the committee was impressed with the department’s accomplishment in filling the gender gap and in diversifying the community by recruiting many international students, especially those from Africa. We also understand the difficulties inherent in trying to reduce the racial gap. However, the committee feels that more deliberate effort needs to be made and that more can be done in this domain. We think a predetermined and thought-out strategy for covering recruiting targeted minorities should be developed and that resources should be given to that effort. We also call on CALS to increase the resources available for such efforts.
June 30, 2017

Professor Samer Alatout, Community & Environmental Sociology (Chair)
Professor Ken Albrecht, Agronomy
Professor Rob Anex, Biological Systems Engineering
Professor Michael Graham, Chemical & Biological Engineering (GFEC Representative)

Sent electronically

Dear Professors Alatout, Albrecht, Anex, and Graham:

Thank you for agreeing to serve on the committee reviewing the academic programs in the department of Agricultural and Applied Economics. The committee is chaired by Samer Alatout. The programs due for review are as follows:

- Agricultural & Applied Economics, BS (10-year review)
- Agricultural & Applied Economics, MS, (10-year review) including a preliminary review of the Resource and Energy Demand Analysis (REDA) Option.
- Agricultural & Applied Economics, PhD (10-year review)
- Agricultural & Applied Economics, Doctoral Minor (10-year review)
- Agricultural Business Management, BS (10-year review)
- Certificate in Development Economics (5-year review)
- Certificate in Business Management for Agricultural and Life Sciences (5-year review) – joint with Life Sciences Communication; this committee will lead the 5-year review of the certificate but will be required to consult the LSC review committee, chaired by Beth Olson, bholson@wisc.edu.

We expect your work to take place over the next few months and would appreciate receiving your report by November 1, 2017. We will forward your final report to the department chair to review for errors of fact and then to the CALS and University Academic Planning Councils.

The self-study document prepared by the program will serve as your main reference for organizing the review. The committee should work with the department chair, Jeremy Foltz, to coordinate meetings with the program’s faculty, staff, and students and to tour the facilities, if appropriate.

The chair of the committee will be responsible for scheduling and convening committee meetings, setting the meeting agendas, making specific assignments to committee members, getting feedback from the committee, overseeing the writing process, and submitting the final report to academicaffairs@cals.wisc.edu with attention to Nikki Bollig and Sarah Pfatteicher.

The review committee final report should provide a summary of the programs’ strengths and challenges as well as recommendations for improvement or focused attention.

The most important question for the committee to consider is the most general: how well is the department fulfilling its mission of teaching and learning? Are there areas that are exemplary? Are there areas that need improvement? If the latter, do you have particular recommendations for steps the department should take to...
strengthen its performance? Paying attention to the following particular issues may help you address the more general questions:

1. How well are the academic programs functioning? Are there sufficient numbers of students in each program and are the students of high caliber? Is student advising functioning well?

2. Should the department be taking any steps to improve the quality of its educational programs? Are student learning goals clear? How is learning evaluated and used for program improvement? How well does the learning assessment plan measure student achievement of learning goals? Are the curricula clear and appropriately designed to achieve the learning goals?

While the focus for the review is the academic programs, it may be useful to briefly address the following questions that provide context surrounding the functioning of the academic programs:

3. What is the standing of the department within its disciplinary base and within the University of Wisconsin-Madison? Is it in need of strengthening? If so, what can be done to improve its standing?

4. How effectively does the department satisfy its outreach and research missions and are these recognized strengths of the department? Are resources deployed in a way that satisfies its stakeholders?

5. Is the climate in the department one that encourages productivity and feelings of inclusiveness by staff, students, and faculty?

6. Are there issues concerning the department's functions or interactions within CALS that should be considered as part of the College’s ongoing strategic planning process?

Please do not hesitate to contact me or Nikki Bollig, Assistant Dean for Academic Programs and Policies, if you have any questions as you proceed. We will represent the dean’s office to assist you in the review process.

Thank you again for taking time on this important task. You are performing a valuable service to the department and CALS, and we all appreciate your efforts. I look forward to seeing your final report.

Sincerely,

Sarah Pfatteicher
Associate Dean for Academic Affairs

cc: Nikki Bollig
Dominique Brossard
Jeremy Foltz
Marty Gustafson
Sarah Kuba
Jocelyn Milner
Dick Straub
Graduate School Applicants, Admits & New Enrollments

This visualization was created by the UW-Madison Graduate School Office of Academic Planning and Assessment. Questions should be directed to Peter Kinsley, peter_kinsley@wisc.edu.
Graduate School Applicants, Admits & New Enrollments

Select Term
Fall Term

Select Student Category
(All)

Degree Level
All

Disciplinary Division
All

Academic Plan
Multiple values

Named Option
All

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<th>Admitted Applicants</th>
<th>New Enrollments</th>
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</tr>
<tr>
<td>Fall, 2017</td>
<td>52</td>
<td>23</td>
<td>7</td>
</tr>
</tbody>
</table>

This visualization was created by the UW-Madison Graduate School Office of Academic Planning and Assessment. Questions should be directed to Peter Kinsley, peter.kinsley@wisc.edu.
Completion Rates: 2007-2015 Entrance Cohorts

- **Completed Plan**: 35.5%
- **Did not complete plan**: 16.1%
- **Left with a Masters**: 23.7%
- **Still enrolled**: 24.7%

This visualization was created by the UW-Madison Graduate School Office of Academic Planning and Assessment. Questions should be directed to Peter Kinsley, peter.kinsley@wisc.edu.
Enrollment in Graduate School Programs

This visualization was created by the UW-Madison Graduate School Office of Academic Planning and Assessment. Questions should be directed to Peter Kinsley, peter.kinsley@wisc.edu.
Enrollment in Graduate School Programs

This visualization was created by the UW-Madison Graduate School Office of Academic Planning and Assessment. Questions should be directed to Peter Kinsley, peter.kinsley@wisc.edu.
Graduate School Time to Degree: 2008-2017

Select Degree Level
- Doctorate
- Master's

Select Student Category
(All)

Disciplinary Division
All

Academic Plan
Agricultural and Applied Economics

This visualization was created by the UW-Madison Graduate School Office of Academic Planning and Assessment. Questions should be directed to Peter Kinsley, peter.kinsley@wisc.edu.
Date: March 29, 2018
To: Sarah Mangelsdorf, Provost and Vice Chancellor for Academic Affairs
From: Barry Gerhart, Interim Albert O. Nicholas Dean, Wisconsin School of Business
Re: Final Summary of Review for Capstone Certificate in Actuarial Science

The first five-year review of the Capstone Certificate in Actuarial Science program was completed in July 2017 by a committee chaired by Alex Hanhart, Associate Director, Department of Mathematics. Kristin Eschenfelder, GFEC member and Professor in the Information School, and Yazhen Wang, Professor, Department of Statistics, also served on the review committee. The review committee’s charge was to complete the first five-year review of the program by addressing the following specific components: (1) Determine whether the goals and objectives as stated in the original program proposal were met and evaluate if the program is meeting standards of quality that are expected based on the original proposal; (2) Confirm that the program is important for its School and understand the program’s relationship to other programs at UW-Madison; (3) Determine if the resource implications of continuing the program are appropriate; (4) Provide recommendations for improvement; (5) Recommend whether the program should continue. The School of Business APC discussed and approved the committee report on February 16, 2018. Based on my review of the review committee’s report and the APC’s response, I am providing the following executive summary of the program review:

Summary of Strengths and Weaknesses

Program faculty have taken actions to ensure program quality, and student satisfaction is good. However, the program is not as large as initially planned. The projected enrollment was an entering class of 5 to 10 students, growing to 25 to 30 students. The program has had an average of 15.5 students per year and awards an average of 7.4 certificates per year. This has not been sufficient to meet a goal of hiring new faculty, but it has produced program revenue used to fund PhD students in Business. Program is successful in paying for itself and more, due to sufficient capacity in existing courses.

The program is important, given the large demand for professional actuaries. The program shares courses and faculty from the Actuarial Science undergraduate major and graduate programs in Risk and Insurance.

The program is making revenue each year. The capstone estimates it has made $967,742.88 gross revenue and $621,575.77 net revenue since its inception in Fall 2011. Because the certificate program requires only existing courses, there are no incremental instructional program costs. Other expenses include (1) the salary and fringe benefits for the Program Director, and 10% of an administrative staff member for assistance; (2) services and supplies; (3) scholarships/financial assistance (PhD student support).
Recommendation for Future Directions

Based on the program review committee’s comments, the program would benefit to improve upon several areas. First, the program could market the program more aggressively. Second, the program should enhance recruitment of women and domestic targeted minorities, possibly through use of program revenue to fund scholarships. Third, the program needs to create an official dated student handbook in PDF form. Finally, the program needs to create and implement an assessment plan for its five stated learning goals to meet Graduate School requirements.

Follow Up

Program Faculty Director Margie Rosenberg and Director Gordon Enderle are working on the recommendations above. Specifically, they are working on creating a stronger advertising program, on and off campus, and are enhancing recruitment of women and domestic targeted minority students, with a goal of eventually using program revenue for scholarships. They plan to complete a formal student handbook in PDF form by the end of this academic year and create a learning goals assessment plan by the end of this academic year).

The program directors have reviewed their implementation form and updated it as needed. Specifically, the learning outcomes have been updated and the new faculty program director and primary staff contact are indicated.

Attachments:
Program Review Committee Report
Updated Implementation Form

Copies:
Margie Rosenberg, Faculty Director, Capstone Certificate in Actuarial Science
Gordon Enderle, Director, Capstone Certificate in Actuarial Science
Alex Hanhart, Chair, Program Review Committee
Jocelyn Milner, APIR
Sarah Kuba, APIR
Bill Karpus, Graduate School
Parmesh Ramanathan, Graduate School
Ella Mae Matsumura, Senior Associate Dean of Academic Programs
Nicole Jennings, Associate Dean for Academic Affairs and Administration
Wisconsin School of Business
University of Wisconsin-Madison

Program Review Report
Capstone Certificate in Actuarial Science

May 2017

Introduction
Dean François Ortalo-Magné charged the committee to complete the first five-year review of the Capstone Certificate in Actuarial Science. The analysis and report were prepared Alex Hanhart (Mathematics) who served as chair of the committee. Kristin Eschenfelder (Information School) represented the Graduate Faculty Executive Committee (GFEC) on the committee. Yazhen Wang (Statistics) served as a committee member. Ruth Lillie (School of Business Dean’s Office) served in an administrative role for the committee and was instrumental in facilitating the program review process.

The committee received the following documents:
- A charge from Dean François Ortalo-Magné
- The self-study prepared by the program faculty and staff
- UW-Madison certificate review guidelines, which also includes an appendix with some advice for the work of the review committee (These guidelines are also available at this link: [http://apir.wisc.edu/uapc/Certificates_Guidelines_4.17.2014_FullPolicy.pdf](http://apir.wisc.edu/uapc/Certificates_Guidelines_4.17.2014_FullPolicy.pdf))
- The original proposal for the Capstone Certificate in Actuarial Science
- Graduate School statistical reports

The committee met three times and collected the following data:
- Meeting with past and current program Directors/Advisors: Margie Rosenberg and Gordon Enderle
- Meeting with one current student
- Qualtrix survey of 4-7 students (not all students answered all questions)
- Email questions to three current program faculty

Response to Charge. In this section, we answer the specific questions put forth in Dean Ortalo-Magné’s charge.

Question #1: Determine whether the goals and objectives as stated in the original proposal are being met. Evaluate the alignment of the expected standards of quality and the reality of what the certificate is offering.

The fundamental goal for the Capstone Certificate program in Actuarial Science is to offer a postgraduate “bridge” for those interested in entering the actuary career and assist them in entering the field. The target audience for this program ranges from recent graduates looking for career preparation to working professionals interested in a career change. The program is built upon existing undergraduate and graduate level courses offered by the Risk and Insurance department whose content is associated
with professional exams necessary for employment in the actuarial field. Originally the program stated a goal of producing sufficient revenue to support additional faculty lines and/or an associated instructor.

The program has been successful thus far in producing employable students. As of Spring 2016, 45 out of 58 students moved into a career associated with the actuarial profession or moved into a post-graduate program. Of the 13 remaining students, 5 were neither employed in the actuarial field nor in graduate school, and we have no data on 8 graduates.

The program is not as large as initially planned. The certificate has had an average of 15.5 students per year and awards an average of 7.4 certificates per year. This has not been sufficient to hire new faculty, but it has produced program revenue used to fund PhD students in Business. Program is successful in paying for itself and more (see #3 below).

Program faculty have taken action to ensure program quality. Entry requirements were increased to ensure entering students were adequately prepared. For example, the program now also encourages students to pass “Exam P” before admission to program if they do not have sufficient recent math coursework. This ensures they will be well prepared for the program and allows them to be more competitive in the fall career fair.

The program has good completion metrics. Further, some students who do not complete the certificate do so because they are able to obtain full time actuarial positions prior to program completion. The program encourages successful actuarial exam passage by counseling students about exam timing and by reimbursing students for the cost of taking exams if the student passes the exam.

A survey of current and former students suggest that overall student satisfaction in the program is good. All surveyed students agreed that they could enroll for the classes they need (100%). Four of 5 students surveyed felt the courses helped them obtain their career objectives and 4 of 5 indicated they received sufficient guidance about courses and program requirements.

**Question #2: Confirm that the program is important for delivery at UW-Madison and understand the program’s relationship to other programs at UW-Madison. Are other programs affected either positively or negatively? Have connections with other programs, as planned in the original proposal, developed as envisioned?**

The program is important. There is a very large demand for professional actuaries and those employed in the field often receive comfortable compensation. Overall interest in the field as a profession has continued in recent years as evident by the over three-fold increase in the student population of the associated undergraduate program since the early 2000s.

The program shares courses and faculty with the Actuarial Science undergraduate major and graduate programs in Risk and Insurance.

Opportunities exist to create relationships with other programs (math, stats, engineering, health policy) especially in recruiting junior and senior undergraduates who might be interested in pursuing the certificate after completion of their bachelor’s degree.

**Question #3: Determine if the resource implications of continuing the program are appropriate.**

The program is making revenue each year. The capstone estimates it has made $967,742.88 gross revenue and $621,575.77 net revenue since inception. Because the certificate program requires only existing courses, there are no instructional program costs. Expenses include:

- the salary and fringe benefits for the Program Director, 10% of an administrative staff member for assistance.
- services & supplies.
- scholarships/financial Assistance (@ $ 21,000.00 to PhD student support).
**Question #4:** Offer the program faculty and/or the dean any advice for program improvement and summarize any actions for follow-up or attention.

Advertising: The program has not aggressively advertised itself either on or off campus. The committee recommends that the program create marketing materials aimed at juniors and seniors in related departments (e.g., math) who may be interested in a career in actuarial science. The committee also recommends that the program work with Division of Continuing Studies to create and implement a regional marketing plan (most students commute regionally).

Recruitment of students of color and women: The program currently has 11% targeted domestic minority students and 35% of students are women. Comparatively, the undergraduate actuarial science major is 6.5% domestic targeted minority students and the undergraduate Business School population is 37% women. Certificate advisors described an effort to raise scholarships from companies to support certificate recruitment, but the review committee also recommend strategic use of program revenue to enhance recruitment of women and domestic targeted minorities into the certificate.

To comply with Graduate School expectations, the program needs to create a formal dated student handbook in PDF form. The program has 5 stated learning goals, but needs to create and implement an assessment plan based on those learning goals to meet Graduate School requirements.

**Question #5:** Provide an explicit recommendation as to whether or not the program should continue.

The review committee recommends that the program continue and expand.
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 and when a certificate is reviewed. 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, [https://apir.wisc.edu/academic-planning/certificates/](https://apir.wisc.edu/academic-planning/certificates/)

Document Date: 3-28-18
Name of Capstone Certificate: Actuarial Science
Faculty Program Director: Margie Rosenberg (margie.rosenberg@wisc.edu; 262-1683)
Primary Faculty/Staff Contact: Gordon Enderle (genderle@wisc.edu; 262-5800)
Home Department/Academic Unit (Name/UDDS): Risk and Insurance/A1232
  Approval Date: October 2010
School/College: Business
  Approval Date: November 2010
GFEC Approval Date: 12-10-10
UAPC Approval Date: 12-16-10
Implementation Term (typically the fall term after UAPC approval): Fall 2011
Year that first program review is scheduled (usually 5 years after implementation) or year most recent program review completed: 2016-17

Information to be completed by APIR:
Plan Code: UNCS009
CIP Code: 52.1304
CDR Certificate Level Code: 6
Primary Divisional Disciplinary Assignment: S

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

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<th>Credits</th>
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</thead>
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<tr>
<td>ACT SCI/MATH 303</td>
<td>Theory of Interest and Life Insurance</td>
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<tr>
<td>ACT SCI 650</td>
<td>Actuarial Mathematics I</td>
</tr>
<tr>
<td>ACT SCI 652</td>
<td>Loss Models I</td>
</tr>
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Specialization Core
Choose at least one of:

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<th>Required Classes</th>
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<tr>
<td>ACT SCI 655</td>
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**Learning Goals:**

List 1 to 5 certificate learning goals:

1. Recognize and explain the concept of risk, and apply the knowledge to the development of insurance products that are used to manage risk for the consumer as well as the risk of those products on the insurance organization.

2. Describe the actuarial profession, including the major professional organizations, the professional obligations of being an actuary, and the requirements to obtain and maintain a professional actuarial designation.

3. Demonstrate skills in critical thinking, quantitative analysis, and communication, as well as to develop an appreciation for actuarial theory, research, and the link to practical application.

4. Demonstrate the soft skills of being a professional.

5. Communicate their experiences and inspire others across the WSOB learning community.

Projections for annual enrollment: The Capstone program has 6 students in Spring 2018. We anticipate a Fall 2018 student body of 5 to 10 students and hope to grow to 20 students per semester over the next 5 years. We plan to maintain the high level of student quality as currently in our undergraduate program for admission criteria for the Capstone Certification program students.

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.

Please answer the following:

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<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
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<tr>
<td>Confirm that the capstone certificate is open to only non-degree seeking University Special students who hold a bachelor’s degree.</td>
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<tr>
<td>Confirm that all credits are required to be earned in residence at UW-Madison.</td>
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<td></td>
</tr>
<tr>
<td>Will there be limits on number of students who can enroll? If Yes, please explain:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm that all core/required courses are approved through the school/college curriculum committee.</td>
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<tr>
<td>Confirm that courses in curriculum are offered on a regular basis and have space for students in this program.</td>
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</tr>
<tr>
<td>Confirm that required courses in the curriculum are numbered 300 or above.</td>
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<td></td>
</tr>
<tr>
<td>Confirm that courses taken as Pass/Fail or Audit are not included in the curriculum.</td>
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Are courses taken Credit/No Credit allowed?  
If yes, specify limits:  

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<th>Confirm that special topics courses are only used if all instances count for the certificate.</th>
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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.) If other requirements, please specify:</td>
</tr>
</tbody>
</table>
| Will exceptions to the course core requirements be allowed?  
If yes, specify limits and process: Exceptions will be determined on an individual basis and are most likely in cases where a student has demonstrated their knowledge of a particular subject through other coursework or passing the associated professional exam. We will substitute other appropriate courses as necessary. |
| In all cases, the courses considered as potential substitutions are 300 level and higher. The exceptions will not diminish the level of the coursework completed to obtain a certificate. |
| 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. |
| The current process is manual, using records entered in spreadsheets resulting from one-on-one discussions with students on their progress during advising sessions. The program is still small enough that this manual approach is feasible. As the program grows, the manual process will become more cumbersome to administer, which is why coding the Capstone curriculum requirements into DARS as the framework for tracking student progress will be beneficial. |
| Assessment plan – confirm that the proposal includes a plan that describes how the program faculty will regularly evaluate student learning. |
| 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. |
| Will this capstone certificate be implemented as a Fund 131 tuition program?  
If yes, has a budget been developed with the Division of Continuing Studies and the sponsoring school/college dean’s office? |

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Capstone Certificate Implementation Form – August 2017 - Page 3 of 4
Who is the appropriate school/college contact for questions? Ella Mae Matsumura
Headcounts of Certificate-Seeking Students

Select Term
- Spring

Select Time Period
- All available (to spring 2008)

Select Topic
- Academic Level

Student Academic Level
- All

Student Term Admit Type
- All

Student School/College
- All

Type of Certificate
- Capstone Certificate

Disciplinary Division of Cert.
- All

School/College of Certificate
- All

Department of Certificate
- All

Certificate
- Capstone Certificate in Actuarial ..

- Special

This visualization was created by Academic Planning and Institutional Research (APIR), Office of the Provost, UW-Madison. Visit [http://apir.wisc.edu](http://apir.wisc.edu) for more information about APIR. Questions should be directed to McKinney Austin, mckinney.austin@wisc.edu Click here to provide feedback on this visualization.