April 30, 2020

To: Wendy Crone, Carl Sovenic, and Douglass Henderson, faculty advisors for the Bachelor of Science in Engineering Physics

From: Laura Grossenbacher, Thatcher Root, and Amanda G. Smith

Cc: Executive Dean Ian Robertson, Associate Executive Dean David Noyce, and EP Dept. Chair Paul Wilson ,

We are submitting our completed review of the Bachelor of Science in Engineering Physics (EP), based on the self study submitted in Fall 2019 and following our meetings with three EP faculty advisors, Wendy Crone, Carl Sovenic, and Douglass Henderson. The objective of the EP undergraduate degree is to provide engineering students with an opportunity to conduct original research guided by a faculty mentor in a technical focus area of nanoengineering, plasma science and engineering, or computational science, though these focus areas can change as new faculty join the program and emerging technologies change and mature. This unique and high quality research experience is coupled with a sequence of research development courses that develop critical thinking and research skills, preparing students well for graduate school or jobs in traditional R&D or high-tech start-up companies. The program has clearly defined learning goals, and students demonstrate achievement of those goals through successful completion of an undergraduate thesis based on their research. Notably, approximately 94% of their students are placed in graduate programs.

Our subcommittee has concluded that the EP program is of high quality and deserves continuation, and we respectfully ask for its continuation. One of our concerns has been that the EP program has been listed by campus as a low enrollment program: it is a small, elite program with some fluctuation in the number of degrees granted from year to year; however, the program graduated 51 students in the past 10 years, and it is housed within a department with two larger programs; its students take courses with those other majors. While EP faculty are working to enhance visibility and retention especially of underrepresented minorities and women, the program's emphasis on direct interaction, targeted feedback, peer mentoring, and high-value research is worth preserving through the selective entrance process they use, which demands that students have a 3.5 GPA or higher to enter the program.

Assessment Summary

To assess the program, our subcommittee reviewed the EP self study along with several supplemental documents that EP faculty shared with us, including assignments, rubrics, and sample student work. We then communicated with the key faculty named above; we found the faculty to be highly responsive and collegial. Below is a summary of the questions that arose during our review of the self study:

1. We aimed to clarify whether the number of graduates from the program should raise concerns about low enrollment: While this is a small program, its students take courses primarily populated by students from other majors, and it is one of three degree programs in the department. Faculty are currently working on new recruitment initiatives.

2. We sought information about their ongoing efforts to retain women and underrepresented minorities; we were also curious about their efforts to enhance visibility of the program overall. They are currently engaged in efforts to attract and retain high quality students, including interacting with new students through a new online orientation system for this summer 2020.

3. We wanted to understand how they have improved the program over the past ten years. Their self study emphasized their development of writing and public speaking elements in their curriculum, as those skills are necessarily coupled with the development of critical thinking and research skills. The program provided assessment data and detailed rubrics along with student sample work in the form of completed research theses. We are satisfied that the communication modules included in their research sequence are well aligned with the skills students develop in their foundational technical communication courses.

4. We revisited the question from the previous review of why the program has not opted to pursue ABET accreditation. They confirmed that their program has a mission focused on research rather than engineering design. The lack of an ABET affiliation has not been a barrier for their students, the vast majority of whom pursue graduate degrees..

More detailed questions we posed during our conversation -- along with the EP faculty responses -- are documented in the following EP Self Study Review. The EP faculty provided a compelling rationale for their approach. Their students are mature, independent learners with the kind of creativity and initiative that makes them sought after by the research faculty in the program and by graduate schools across the nation. We respectfully request that the B.S. in Engineering Physics program be considered for continuation.

Review of the Engineering Physics Undergraduate Program

April 29, 2020

Undergraduate Program Review Process

The College of Engineering typically reviews undergraduate programs through a summary of the ABET Self Study, but we have one program, Engineering Physics, which is not an ABET-accredited program. Our process for reviewing non-accredited programs includes first a review of the program's self study by a subcommittee from the Undergraduate Program Review Committee (UPRC). Our subcommittee for this review is made up of Laura Grossenbacher, Thatcher Root, and Amanda G. Smith. Our review produced seven questions, and we met on April 22, 2020, with three representatives from Engineering Physics: Wendy Crone, Carl Sovenic, and Douglass Henderson. Below are our seven questions and a summary of the responses from the EP representatives.

1. Clarifying how the BSEP Program is addressing fluctuating enrollments. Our review process revealed a concern from our campus Academic Planning and Institutional Review office that the EP undergraduate degree qualifies as a "low enrollment" program: while it is true that EP is slightly below five graduates a year for their five-year average, the EP program has graduated 51 students in the past ten years. The number of degrees awarded do fluctuate from year to year, but we believe that the campus should consider several important factors: first, EP students are required to take several fundamental courses that are also required within the department for Engineering Mechanics and Mechanical Engineering students, both of which are programs that graduate far more students. In other words, the additional students for the EP degree are not adding a significant workload in those courses. The courses that make up the research sequence that is specific to the EP degree are handled as "meets with" courses to encourage collaboration between seniors, juniors, sophomores, and this combined approach to the research course sequence seems to be well-managed by a teaching rotation amongst EP faculty. Finally, the EP program is well aware of the enrollment fluctuations and has begun several new initiatives to enhance visibility and attract new students to the program, beginning even this summer through an online orientation program. Thus, we feel the enrollment challenges are being addressed sufficiently.

> **Summary of Response from EP:** The main "cost" associated with this degree program is the research sequence courses which are taught in a "meets with" fashion by one faculty member each semester. All other courses that EP students take are populated primarily by students from other majors. It is also one of three majors that the department offers. The faculty who teach and advise in EP also teach and advise in Engineering Mechanics and/or Nuclear Engineering.

2. Retaining minorities and women. We have noticed a slight downward trend for minorities and women from the time they enrolled in the program to the time their degrees are awarded. First, we wonder if there is a way to put that trend in a larger context: what is happening across the College of Engineering in terms of drops in enrollment for women and minorities? Is this pretty standard, and even if it is – what plans have been made for more effectively retaining those students? We recognize of course that this is an elite program, and that sometimes students decide they aren't as interested in research or grad school: but within an elite major, faculty likely have a deep interest in recruiting and retaining elite minorities and women for the pipeline to research and potentially faculty positions.

Summary of Response from EP:
The representatives from the EP program provided thoughtful responses to address all concerns the review committee brought up. The review committee received the following written response to this question:

> "It is difficult to say that this is a "trend" given the small numbers involved. However, the Department of Engineering Physics is highly committed to diversity and our 2018-2023 Strategic plan has a strategic priority to "Prepare a diverse population of high-caliber students for engagement with society, entrepreneurship, and leadership in industry, research, government, and academia." Our strategies include:
>
> 1. Recruit a diverse and robust student body, staff, and faculty, sustaining excellence while strategically growing the Department.
>
> 2. Build curriculum and research programs that allow our graduates to succeed in a wide range of career paths.
>
> 3. Foster a welcoming climate that values the contributions of all faculty, staff, and students.
>
> Action items include:
>
> - "Develop a plan to establish departmental visibility and engage with prospective and incoming students before they apply. As part of this effort, target faculty, staff, students, and alumni to interface with community organizations as channels for recruitment. Establish a public story in recruitment and enrollment that demonstrates the quality of students recruited and the success of our alumni."
> - "Create a program to involve all faculty, staff, and students in developing media and social media content"
> - "Establish a mentoring and advising program that formally joins faculty, staff, and students in the process""

During the meeting between the review committee and the EP Program representatives, it was mentioned that the EP Department has recently hired three female faculty members, which they expect will help with retention of female-identifying students. Because success in the EP

Program relies heavily on mentorship of young students by more advanced students, it seems likely that maintaining some level of minority enrollment will be key in ensuring younger minority students are well represented.

3. Improving enrollments and recruiting efforts. A somewhat related question is that the EP Industrial Liaison Committee has commented on the need to attract well-qualified new students to the degree: we understand your concern that the "direct admit" policy makes identifying and attracting promising new students more difficult. Has the program made progress on their marketing and recruitment efforts since this self-study was submitted, which was now – eight months ago? Are there any new recruitment plans, particularly given the challenges COVID-19 poses for recruitment this summer? What is your target enrollment to maintain a sustainable program?

Summary of Response from EP:

The EP Program Representatives described how they are trying to think creatively about recruiting; in fact, COVID-19 changes to recruitment may provide new opportunities, because there will now be separate online informational sessions for each one of their majors in the department available to admitted high school students. In the past, the EP Program has had to share the information session time with Engineering Mechanics and Nuclear Engineering, which is a challenge for all three majors to navigate. The EP Program may consider using online sessions for recruiting even after in-person campus events resume. They also conduct one-on-one conversations about the major with prospective students, and that helps communicate that it is a different kind of major. They are also encouraging students to take the first course of the research sequence in their sophomore year, where they can learn what the major involves and the commitment it takes. They could have a higher enrollment, but they do not want to sacrifice quality, and they recognize the level of commitment required of faculty research mentors has limitations; they would not be able to be four times larger, for example. They'd like to see their different emphasis areas and year-to-year enrollment more evenly distributed so that students working together have a strong cohort within their research emphasis, but they do have a sense of community because the upper-level students interact weekly with newer students through the research sequence.

It should be noted that there is a cap on how many additional students faculty can effectively manage, as taking on an undergraduate research student is akin to taking on a graduate student in terms of time commitment. At the same time, the faculty are happy to get these students because they work very hard, and they are great independent learners. The standards for this program are high, and the enrollment is kept intentionally managed to sustain the high quality of the educational experience.

4. Understanding the specific skills covered in the research sequence. Can you provide us with more details about what is being taught in the research sequence (EP 468, EP 469, EP 568, and EP 569)? What

part of the sequence is made up of a research apprenticeship working with a research group, and how much of it is developed and delivered as a coordinated pedagogy for all EP students? For example – it sounds like new material has been added about writing and public presentations: how much time is spent on teaching the students to effectively communicate? Is there a great deal of individual feedback to help with those skills?

Summary of Response from EP:
Wendy Crone created a Box folder as a response to this question and shared syllabi, grading rubrics, and her own new textbook draft, an *Introduction to Engineering Research* (Jan. 2020), where the table of contents clearly shows a rich pedagogical approach with scaffolded assignments that build student abilities to research, think critically, write, and present about their research. A sample rubric from the written proposal is included in this review as Appendix A, merely as an example to show the rigor of the approach. The team of faculty we met with explained that a great deal of time is spent workshopping writing in peer review teams (an approach they developed through consultations with Brad Hughes of the UW Writing Center), and faculty mentors provide significant feedback on drafts to ensure students are learning and improving. It is clear that this program provides both a research apprenticeship and a well-coordinated pedagogy that ensures success for their students.

5. Determining whether the communication sequence is useful. One function we could perform as a committee is to take a look at a sample set of written research reports from your students, to determine whether there is validity to the student feedback that the EPD course sequence (EPD 275 and InterEGR 397) is not valuable. In the survey, two students noted that the sequence is redundant: is it? We are interested in EP468 and 469 – could we get writing samples from these courses that occur BEFORE EPD 397, and maybe look at a few samples from the research courses taken after 397, so we can get a better sense of whether these students seem to benefit at all from "the EPD sequence"? Of course -- we would also like to see what the core EP faculty think about this question. Do both of our courses (275 and 397) help with your mission, or could it be that one or both are irrelevant to your students? We know 397 is serving a CommB role (Gen Ed requirement), but would there be a benefit from making 397 just an option, so that students are free to take any CommB on campus?

Summary of Response from EP:
Wendy Crone provided a valuable insight on this question: she noted that because of a bottleneck problem with both of the EPD courses, EP students rarely are able to enroll in these courses in their sophomore and then junior year, as their curriculum was originally designed: her point is that when the sequence of EPD 275 and 397 can be taken early enough and in order, students are less likely to see it as redundant. Our committee is well aware of the bottleneck challenges with EPD courses, and we see these as an ongoing problem we will continue to try to address. Some gains may be made through offering more sections in the summer.

The EP faculty note that the writing and presentation work done in the Research Sequence courses are targeted to specific objectives. Examples include comparing and contrasting

published journal articles that one might cite in a research paper and developing essential elements for a persuasive technical proposal. They rely on foundations in technical presentation and technical writing that is provided elsewhere, namely EPD 275 and InterEGR 397. We found general agreement from these faculty that the communication sequence of 275 and 397 are valuable to EP students because these courses help prepare students for the challenges of drafting, revision, research, and presentations, and these are skills they will develop further and build upon in the EP research sequence.

As further demonstration of the communication elements that have been developed in their research sequence, Wendy Crone created a "Research Sequence Rubrics" folder which also includes a writing workshop description: "Writing Workshops for the Engineering Physics Research Sequence." To accompany those pedagogical materials, Dr. Crone shared a Box folder showing samples of strong, middle, and weak thesis reports from EP. These projects all exhibit a high level of research and disciplinary depth, beyond what is typically possible in the InterEGR 397 course, which puts more focus on interdisciplinary communication. The complexity of these EP reports suggests that InterEGR 397 is a useful first step that could develop foundational skills to support such future work. We should strive to help these EP students take the EPD courses in the proper curricular sequence when we can.

6. Directly measuring student outcomes. Could we see the 5-page document that is a direct assessment of student learning? How do the research mentors assess some of those "softer" skills? How do EP students perform in comparison to other COE students in skills such as communication, ethics, teamwork, and lifelong learning, particularly in courses where students from multiple majors are working side-by-side (as in InterEGR 397)?

Summary of Response from EP:

The 5-page assessment of student learning that is completed by the faculty mentor is included in Appendix B. The process is iterative; EP students complete a self assessment of a range of different softer skills, well beyond communication, ethics, teamwork, etc. -- they assess their own interpersonal skills, stress management, and professionalism, but then they consult with a faculty mentor who can provide their own feedback on how the student is managing these demands. While the assessment process is time-consuming, it also provides individualized feedback that would be very valuable and useful for a student planning to go to graduate school.

Our discussion about communication and ethics made clear that the guidance these EP students are receiving is well-aligned with coaching they are receiving in InterEGR 397, and in fact we learned of some practices common in EP that would be beneficial if they were possible for other programs in CoE: students are given workshops not only on Responsible Conduct of Research, but also on a host of life-long learning skills like money management, mindfulness, and stress management.

7. Justifying the ABET-esque approach. While your Student Outcomes and other components in your evaluation materials follow much of the pattern used by other, ABET-accredited programs in CoE, the EP program has not sought accreditation. There are 21 other engineering physics programs in the US with ABET accreditation, and even UW-Platteville is ABET accredited: can you provide a bit more detail describing why you decided that accreditation isn't necessary for your students? Even students noted in their survey answers that they'd like to see the degree be ABET accredited. We think it would be beneficial to have a thoughtful statement (one paragraph) about why the program is designed with different goals in mind. Some of this would also be useful in your published materials. Have you thought about a way to do some form of benchmarking against peer universities that are ABET accredited? How does your degree stack up *or surpass* what those peer universities offer?

Summary of Response from EP:

The EP faculty made clear that the lack of ABET accreditation is not an impediment for their students, many of whom are interested in research and bound for graduate school. They reiterated that they place 94% of their students in graduate schools, and in this small community the lack of undergraduate program accreditation has never been a problem. They have no interest in altering the program priorities away from research to meet the design course requirements of ABET, because teaching students engineering design skills is not relevant for this career track. They are up front about their reasons for not seeking ABET as students are entering the program. Any later concerns by students who raised this issue in their feedback may be attributed to hearing unrelated comments of friends in other departments, or placement folks from other disciplines. This would thoughtfully be addressed by reminder clarifications when these concerns may arise, along with the reiteration that a PE license can be achieved without a degree from an ABET accredited program, though the process takes a little longer. Almost all of the EP students go on to grad school, and into careers where professional licensure is not needed. The committee also noted that when they review students applying to their own grad program, undergraduate program ABET accreditation *per se* is not a consideration: they're interested in the quality of the application itself.

Notably, the same question about EP accreditation came up in the EP review from 2010, and they considered the issue and responded similarly then. They have provided more detailed reasons emphasizing their research mission in Appendix C. Notice especially their response to our question about other institutions with EP degrees accredited by ABET:

"Although it is true that some intuitions have sought and received ABET accreditation for their Engineering Physics degrees, not all have chosen to pursue accreditation. Notably, institutions which we see as peers also have Engineering Physics degrees that are not ABET accredited. For example:

University of Michigan
University of California, Berkeley
Cornell University"

Therefore, the EP faculty use portions of the ABET assessment/evaluation framework as they find useful, both because those Outcomes do align with their program needs, and because associated UW programs already have this focus and the evaluations are familiar and useful. They have well-reasoned justification for omitting the design-related components, and thus have chosen to not pursue ABET accreditation just as some other, select programs in EP and other disciplines have.

EP469 Evaluation of Written Thesis Proposal

Student's Name: _____

Research Mentor: _____

Brief Description of Research Project:_____

_____

5 = Excellent; 4 = Good; 3 = Average; 2 = Poor but still acceptable; 1 = Unacceptable

5 4 3 2 1 **Rationale and Objectives** (identifies thesis topic; establishes its significance and context; supports arguments with evidence and references; lists objectives).

5 4 3 2 1 **Review of Technical Literature** (demonstrates mastery of published technical literature; explains how project will build on and surpass others; supports argument with evidence and references).

5 4 3 2 1 **Project Activities:** Activities, Schedule, Personnel, and Resources (presents logical, realistic, and complete steps of tasks and timeline to completion of thesis).

5 4 3 2 1 **Expected Outcomes** (defines success and ways to measure it).

5 4 3 2 1 **Bibliography** (includes sufficient number of authoritative sources, complete reference citations provided).

5 4 3 2 1 **Figures and Tables** (clarify material in text; are properly labeled and sourced).

5 4 3 2 1 **Presentation** (demonstrates professional skill with format, grammar, diction, style, organization, pagination, spacing, font size, and margins).

5 4 3 2 1 **Overall Persuasiveness** (makes a persuasive case that problem chosen is significant and not adequately addressed at present; presenter has a viable approach and detailed plan, a clear idea of what will constitute success, and the qualifications and other resources needed).

Yes No **Project Scope** (scope of project will challenge student's abilities and has reasonable chance of completion in time frame provided)

Comments:

_____

_____

_____

Yes No **Equipment/Resources** (materials, equipment, and/or facilities available to student are adequate)

Comments:

_____

_____

_____

GRADE:_____

( ) **Approved.** Correct typographical/mechanical errors.
( ) **Not approved at this time.**

Corrective Actions Required:

_____

_____

_____

_____ DATE: _____

Research Mentor's Signature

EP469 Evaluation of Written Thesis Proposal

Student's Name: _____

EP 469 Instructor: _____

Brief Description of Research Project:_____

_____

Evaluator: _____

5 = Excellent; 4 = Good; 3 = Average; 2 = Poor but still acceptable; 1 = Unacceptable

5 4 3 2 1 **Introductory sections:** Title Page, Table of Contents, and Abstract or Executive Summary (contains all necessary information; provides reader with clear overview of rest of report).

5 4 3 2 1 **Rationale and Objectives** (identifies thesis topic; establishes its significance and context; supports arguments with evidence and references; lists objectives).

5 4 3 2 1 **Review of Technical Literature** (demonstrates mastery of published technical literature; explains how project will build on and surpass others; supports argument with evidence and references).

5 4 3 2 1 **Project Activities:** Activities, Schedule, Personnel, and Resources (presents logical, realistic, and complete steps of tasks and timeline to completion of thesis).

5 4 3 2 1 **Expected Outcomes** (defines success and ways to measure it).

5 4 3 2 1 **Bibliography** (includes sufficient number of authoritative sources, complete reference citations provided).

5 4 3 2 1 **Required Appendices:** Budget and Equipment Checklist, Biographical Sketch of Student

5 4 3 2 1 **Figures and Tables** (clarify material in text; are properly labeled and sourced).

5 4 3 2 1 **Presentation** (demonstrates professional skill with format, grammar, diction, style, organization, pagination, spacing, font size, and margins).

5 4 3 2 1 Ability to **identify, formulate, articulate, and solve engineering problems**; think critically about problem definition, engineering design, and project management.

5 4 3 2 1 Ability to **communicate effectively** with both expert and non-expert audiences.

5 4 3 2 1 **Overall Persuasiveness** (makes a persuasive case that problem chosen is significant and not adequately addressed at present; presenter has a viable approach and detailed plan, a clear idea of what will constitute success, and the qualifications and other resources needed).

Yes No **Project Scope** (scope of project will challenge student's abilities and has reasonable chance of completion in time frame provided)

Comments:

_____

_____

_____

Yes No **Equipment/Resources** (materials, equipment, and/or facilities available to student are adequate)

Comments:

_____

_____

_____

GRADE:_____

( ) **Approved.** Correct typographical/mechanical errors.
( ) **Not approved at this time.**

Corrective Actions Required:

_____

_____

_____

_____ DATE: _____
Signature

EP568 and EP569
Evaluation of Research Progress and Researcher Development

(To be conducted by research mentor mid-semester and end of semester in EP568 and mid-semester in EP569)

Student's Name: _____

Research Mentor: _____

Brief Research Project Description: _____

_____

Comments:

_____ DATE: _____
Research Mentor's Signature

Milestones and Timeline: The ability to set realistic goals and use time and resources effectively; to obtain the maximum benefit from a minimum investment of time and resources.			
❒ Unacceptable ❒ Unable to Evaluate	❒ **Beginning** Demonstrated by: • focusing on tasks at hand without dwelling on past mistakes • completing assignments on time making use of reference books and literature • coordinating and working with others on group project assignments • preparing for scheduled appointment times • using unscheduled time efficiently	❒ **Developing** Demonstrated by: • planning ahead • setting up an effective schedule • coordinating schedule with others • demonstrating flexibility • moving forward when mistakes are made • accepting responsibility in group activities • identifying alternative resources • using library and internet resources effectively • updating solutions based on review of available literature	❒ **Mastery** Demonstrated by: • setting priorities and reorganizing as necessary • performing multiple tasks simultaneously • delegating when appropriate • following up on projects in a timely manner • managing meeting time effectively • considering professional goals in the context of project • demonstrating the ability to say "no" if requests made in conflict with set goals • actively seeking resources to solve problems or answer questions • using limited resources creatively

Research Documentation: The ability to effectively document research approach, progress, hypotheses, and outcomes.

❒ Unable to Eval ❒ Unacceptable	❒ **Beginning**	❒ **Developing**	❒ **Mastery**
	Demonstrated by: • recording research findings • identifying methods used	Demonstrated by: • keeping record of research progress • writing out steps to possible solution • providing documentation that others can follow	Demonstrated by: • describing thought processes, hypotheses and outcomes • supporting methods chosen with literature references • using project managements tools to stay on task

Scientific Literacy: The ability to use processes and skills of science to conduct investigations; to recognize and define problems, analyze data, develop and implement solutions, and evaluate outcomes.

❒ Unacceptable ❒ Unable to Evaluate	❒ **Beginning**	❒ **Developing**	❒ **Mastery**
	Demonstrated by: • recognizing problems • identifing questions • knowing the basic steps of the problem- solving process (stating the problem, describing known solutions, identifying resources needed to develop solutions, beginning to examine multiple solutions to the problem) • seeking to fill gaps in knowledge • understanding differences between primary, secondary and other sources	Demonstrated by: • distinguishing between fact and hypotheses • applying the problem-solving process • prioritizing problems • consulting with others to clarify the problem • identifying contributors to the problem • accepting responsibility for implementing solutions • considering consequences of possible solutions • generating alternative plans when difficulties or obstacles present themselves	Demonstrated by: • forming possible solutions • designing a data collection scheme and collecting data • drawing conclusions about the validity of the possible solution • seeking alternative hypotheses and contradictory ideas • evaluating outcomes • reassessing solutions

Critical Thinking: The ability to question logically; to identify, generate, and evaluate elements of logical argument; to recognize and differentiate facts, illusions, assumptions and hidden assumptions; and to distinguish the relevant from the irrelevant.

❒ Unacceptable ❒ Unable to Evaluate	❒ **Beginning**	❒ **Developing**	❒ **Mastery**
	Demonstrated by: • considering all available information • recognizing gaps in knowledge base • articulating ideas/problems • raising relevant questions	Demonstrated by: • understanding scientific methods • critiquing hypotheses and ideas • formulating alternative hypotheses and ideas • examining new ideas • being able to distinguish relevant from irrelevant information • recognizing fact vs. opinion	Demonstrated by: • exhibiting an openness to contradictory ideas • assessing issues raised by contradictory ideas • justifying selected solutions • determining effectiveness of applied solutions • identifying complex patterns of associations • demonstrating intuitive thinking • distinguishing when to think intuitively vs. analytically • recognizing own biases and suspending judgmental thinking • challenging others to think critically

Commitment to Learning: The ability to self-assess, self-correct, and self-direct; to identify needs and sources of learning; and to continually seek new knowledge and understanding.

❒ Unacceptable ❒ Unable to Evaluate

❒ Beginning	❒ Developing	❒ Mastery
Demonstrated by: • identifying problems • identifying needs for further information • formulating appropriate questions • identifying and locating appropriate resources • attending class consistently • showing evidence of preparation prior to class • showing attentiveness • demonstrating a positive attitude toward learning • participating in small groups • offering own thoughts and ideas	Demonstrated by: • identifying own learning needs based on previous experiences • setting personal and professional goals • seeking new learning opportunities • seeking out professional literature • prioritizing information needs • reconciling differences in opinions or information • analyzing and subdividing large questions into components • demonstrating confidence in presenting material	Demonstrated by: • researching and studying areas where knowledge base is lacking • reading articles critically and understanding limitations • accepting that there may be more than one answer to a problem • recognizing the need to verify and then verifying solutions to problems • formulating and re-evaluating position based on available evidence • demonstrating confidence in sharing new knowledge

Communication Skills: The ability to communicate effectively (i.e., speaking, body language, reading, writing, listening) for varied audiences and purposes.

❒ Unacceptable ❒ Unable to Evaluate

❒ Beginning	❒ Developing	❒ Mastery
Demonstrated by: • understanding and applying English (verbal, written, grammar, spelling, expression) • communicating appropriately per situation • providing appropriate feedback to team members and faculty • recognizing differences in communication styles • recognizing impact of non-verbal communication: maintaining eye contact, listening actively	Demonstrated by: • modifying communication when necessary • reflecting, clarifying, and restating messages • utilizing non-verbal communication to augment verbal messages • exhibiting appropriate communication per situation • maintaining quality in all written work • maintaining quality in all oral work • utilizing technology in presentations	Demonstrated by: • modifying written and verbal communication to meet needs of various audiences • presenting verbal or written messages with logical organization and sequencing • maintaining open and constructive communication • communicating professional needs and concerns • utilizing communication technology effectively

Interpersonal Skills: The ability to interact effectively with faculty research mentor, scientific staff, graduate students, team members, and other department personnel, and to deal effectively with cultural and ethnic diversity issues.

❒ Unacceptable
❒ Unable to Evaluate

❒ Beginning	❒ Developing	❒ Mastery
Demonstrated by: • maintaining attentive behavior • demonstrating acceptance of limited knowledge and experience • communicating with others in a respectful, confident manner • appropriate behavior in discussion • maintaining professional demeanor in interactions • respecting differences in others • recognizing impact of non-verbal communication	Demonstrated by: • seeking to gain knowledge and input from others • assuming responsibility for own actions • establishing trust and motivating others • recognizing impact of non-verbal communication and modifying accordingly • discussing problems with the appropriate person(s)	Demonstrated by: • approaching others to discuss differences in opinions • talking about difficult issues with sensitivity and objectivity • responding effectively to unexpected situations • delegating to others as necessary

Use of Constructive Feedback: The ability to identify sources of feedback, to seek out feedback, and to effectively use and provide feedback for improving personal interaction.

❒ Unacceptable
❒ Unable to Evaluate

❒ Beginning	❒ Developing	❒ Mastery
Demonstrated by: • using active listening skills • showing a positive attitude • critiquing own performance • maintaining two-way communication • actively seeking constructive feedback and assistance	Demonstrated by: • assessing own performance accurately • seeking, accepting, and integrating feedback from others • developing a plan of action in response to feedback	Demonstrated by: • considering multiple approaches when responding to feedback • modifying feedback given to others according to their learning styles • engaging in non-judgmental, constructive, problem-solving discussions • reconciling differences with sensitivity

Professionalism: The ability to exhibit appropriate professional conduct and to represent the profession effectively.

❒ Unacceptable
❒ Unable to Evaluate

❒ Beginning	❒ Developing	❒ Mastery
Demonstrated by: • following University, Department, and research group policies • demonstrating honesty, integrity, and respect to others • seeking opportunities for leadership • demonstrating an awareness of the professional role of the engineer in society	Demonstrated by: • participating in professional activities/organizations • identifying positive professional role models • discussing societal expectations of the engineering profession • awareness of the impact of ethical issues and legal issues on the engineering profession • acting on moral commitment	Demonstrated by: • acting in a leadership role • actively participating in professional organizations • actively promoting the engineering profession • advancing the engineering profession outside of the academic program

Responsibility: The ability to fulfill commitments and to be accountable for actions and outcomes			
❒ Unable to Evaluate ❒ Unacceptable	**❒ Beginning** Demonstrated by: • being punctual • completing tasks in a timely manner • following through on commitments • accepting responsibility for own actions and outcomes • recognizing own limits	**❒ Developing** Demonstrated by: • providing constructive feedback to the appropriate person(s) • offering and accepting help • completing projects without prompting • contributing to the provision of a safe and secure environment	**❒ Beyond Entry-Level** Demonstrated by: • promoting education • accepting leadership roles • delegating as necessary

Stress Management: The ability to identify sources of stress and to develop effective coping behaviors.			
❒ Unable to Evaluate ❒ Unacceptable	**❒ Beginning** Demonstrated by: • recognizing own stressors or problems • recognizing stress or problems in others • seeking assistance as necessary • demonstrating appropriate responses • maintaining professional demeanor	**❒ Developing** Demonstrated by: • accepting constructive criticism appropriately • handling unexpected changes appropriately • maintaining balance between professional and personal life • establishing outlets to cope with stressors	**❒ Mastery** Demonstrated by: • recognizing when problems are unsolvable • demonstrating a preventive approach to stress management • offering solutions for stress reduction • assisting others with stress • establishing a support network • prioritizing multiple commitments • tolerating inconsistencies • responding calmly to urgent situations

Project-Specific Research Skill: 1)			
❒ Unacceptable	**❒ Beginning** Demonstrated by: • • •	**❒ Developing** Demonstrated by: • • •	**❒ Mastery** Demonstrated by: • • •

Project-Specific Research Skill: 2)			
❒ Unacceptable	**❒ Beginning** Demonstrated by: • • •	**❒ Developing** Demonstrated by: • • •	**❒ Mastery** Demonstrated by: • • •

Appendix C
EP Self Study Review, April 2020

Date: 4/18/20
To: EP Self Study Review Committee members Laura Grossenbacher, Thatcher Root, Amanda G. Smith
From: Wendy Crone, Department of Engineering Physics
RE: Response to committee's request to "Justifying the ABET-esque approach"

As noted by the EP Self Study Review Committee, some Engineering Physics degree program in the U.S. are ABET accredited, while the Department of Engineering Physics has chosen not to seek ABET accreditation for the B.S. in Engineering Physics degree (despite having two other degree programs which are ABET accredited). As we discussed in our 2010 review this was carefully considered and intentional decision on the part of the department (see below).

First it should be noted that Engineering Physics degrees across the nation differ quite extensively from one another. They share many fewer traits than other engineering degrees of the same name would. In particularly, our Engineering Physics degree is ***research***-based and culminates in an undergraduate ***research*** thesis. Our students are exposed to the basic principles of engineering design through the common coursework they take in the first two years, but the students do not have extensive exposure to engineering design beyond that. Rather, their emphasis is ***engineering research***. The ABET student outcome of "an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors" is not something our program is focused on.

However, in a desire to create well-educated engineers, we have adapted this outcome to be "an ability to apply engineering research practices to produce results that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors". You will note the use of research rather than design in this statement. The research focus is at the heart of our degree program and we feel the program would be significantly diminished if we were expected by ABET to achieve the outcomes they identify for design and the research outcomes our faculty has focused on given the time constrains of an undergraduate degree program. Additionally, the Engineering Physics degree program is working as intended given that 94% of our graduates have gone on to attend graduate school.

Further, although it is true that some intuitions have sought and received ABET accreditation for their Engineering Physics degrees, not all have chosen to pursue accreditation. Notably, institutions which we see as ***peers*** also have Engineering Physics degrees that are ***not*** ABET accredited. For example:

University of Michigan
http://eng-physics.engin.umich.edu/

University of California, Berkeley
http://guide.berkeley.edu/undergraduate/degree-programs/engineering-physics/

Cornell University
https://www.engineering.cornell.edu/programs-departments/applied-and-engineering-physics

An excerpt below from:

Self-Study in support of
JOINT PROGRAM REVIEW
of
Bachelor of Science in Engineering Physics
in the
Department of Engineering Physics
University of Wisconsin, Madison
January 2010

"4.5 Accreditation
Contrary to the initial expectation of the department when planning this degree program, the faculty have decided not to seek ABET accreditation for the Engineering Physics major at this time. Our primary reason for this change was the lack of value in such accreditation for a research-oriented program such as this. ABET traditionally stresses the engineering design process. Our students are exposed to the basic principles of engineering design through the common coursework they take in the first two years. However, the degree program is primarily focused on cross-disciplinary research in areas of emerging technology where new types of engineering develop from applied science. In place of the design capstone sequence, the EP students complete a four semester research sequence culminating in a written thesis which is defended in a final oral presentation.

The two other degrees offered by the department are ABET accredited (B.S. in Nuclear Engineering and a B.S. in Engineering Mechanics), so the BS-EP students are exposed to ABET-approved engineering methods, and our faculty applies the same level of scrutiny in assessment of degree requirements. As with our other majors, we seek feedback from students on a regular basis, including their annual interaction with our Industrial Advisory Board, and ask them to complete the departmental exit interview and EBI survey upon graduation, as do the graduates from our other majors. Beyond these standard evaluation measures, student feedback is sought twice a year during the final meeting of the research sequence classes of the semester."

An excerpt below from:

TO:	Paul M. DeLuca, Jr., Provost, University of Wisconsin-Madison
CC:	Jocelyn Milner, University Academic Planning Council
FROM:	Joint Review Committee for the BS-Engineering Physics; members: Mark Eriksson, Professor of Physics; Wendy Crone, Professor of Engineering Physics; Lisa Beckstrand, Academic Planner; Christopher DeMarco, Professor Electrical & Computer Engineering, and committee chair
DATE:	April 22, 2010

"The one concern that occupied the Review Committee's March 19 discussion was that, contrary to the plan outlined in the 2003 Implementation Proposal, the EP program has chosen not to

pursue ABET accreditation for its degree. As noted in the 2010 Self Study, the rationale for this choice was twofold: (i) that the research oriented students attracted by the program are likely to pursue career paths (most notably graduate school) for which an accredited degree is not of value; (ii) some coursework and program modification that might be necessary to meet ABET requirements (e.g. capstone design) would detract from the quality of the degree's research focus. While some review committee members initially expressed doubts regarding the wisdom of not seeking accreditation, Professor Crone (as program representative to the committee) indicated that this choice and the reasons supporting it were consistent with other highly regarded Engineering Physics degree programs in the U.S. Following the Review Committee's March 19 meeting, she was able to promptly secure correspondence from several highly regarded, peer U.S. universities documenting this. In particular, she provided the committee with correspondence from: (i) University of Michigan, indicating that ABET accreditation not sought there, and was viewed as counter to degree objectives; (ii) University of California, Berkeley, similarly citing view that ABET objectives not consistent with EP degree objectives; (iii) Cornell University, which in the past held ABET accreditation for its EP degree, chooses now not to pursue ABET accreditation henceforth, citing lack of discernable value to students."