February 21, 2018

William Karpus, Dean
Graduate School
University of Wisconsin - Madison

Dear Bill,

At the February 21, 2018 meeting of the College of Engineering Academic Planning Council, the following named option program was recommended for approval:

• Master of Science: Biomedical Engineering Accelerated Program, Dept. of Biomedical Engineering

The proposal is attached.

We are excited about the prospects for increasing our enrollment of terminal Masters students, given the targeted, accelerated nature of the proposed option. In addition, we have created these 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: Biomedical Engineering
   1.3. Home Department: Biomedical Engineering
   1.4. School/college: Engineering, School of
   1.5. Partner department(s)/units/schools/colleges: none
   1.6. Chair of the Major (name, title, email): Justin Williams, Chair, jwilliams@engr.wisc.edu
   1.7. Primary faculty or staff contact for the proposal (name, title, email): Beth Meyerand, Associate Chair, memeyerand@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 degree in Biomedical Engineering. The purpose of the named option is to provide a Master of Science program that is course-based, accelerated (12 month duration) and terminal, where this will provide further training for students entering the workforce or pursuing advanced academic degrees. This approach will allow us to recruit from a broader audience interested in terminal Masters degrees and thus increase our graduate enrollment.

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

   1.10. Date form completed: 10/26/2017

2. Approval Implementation and Expectations for Review
2.1. School/College Approval Date: 2/21/2018
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
The BME graduate program was reviewed in Spring 2017, and approvals were obtained by both
COE and GFEC.

3. Background/Rationale
3.1. How does the named option relate to the major and to other named options in the major, if
relevant?
This program is complementary to our research-focused programs, but has a more practical
focus (given the accelerated timetable and lack of a thesis). The MS-Biomedical Engineering
degree has an option for a thesis but in the past many students have not taken this option. The
department plans to keep the MS-Biomedical Engineering in place to keep the option open for
MS students to choose a thesis route for their degree.

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 – Biomedical Engineering
program which is course-based and accelerated (students finish in one calendar year). Typically,
BME students need a broad range of courses for the BS, and this program will be dedicated to
additional coursework in engineering and sciences to afford better preparation for further
education in medical school or PhD programs, e.g. in BME, other engineering disciplines or
biology disciplines, either by satisfying prerequisites or by broadening in knowledge over the BS
level. Similarly, the program will provide further training for those interested in careers in
industry. The named option contributes significantly to the mission of the Department of
Biomedical Engineering by increasing the number of master-level graduate students and
enhancing the reputation of the Department and UW internationally.

3.3. What is the evidence that there is a student demand for the named option?
Currently the majority of the BME MS students are our own BS students who complete a 24
credit MS with carryover credits. Each year we received many MS applicants, both domestic and
international, that receive little consideration by the admissions committee due to the historic
focus on research-oriented degrees. Students in this program will understand that funding will
not be available.

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 course work in Biomedical Engineering
(1) At least 3 credits of a biological science
(2) At least 12 credits of engineering
(3) 2 semesters of BME 701

The College of Engineering has developed an internal system for sharing tuition revenue among engineering departments for cross-enrollment of students in revenue generating programs. Additionally, the College of Letters & Science (L&S) and the College of Engineering (CoE), and the School of Medicine and Public Health (SMPH) and the Department of Biomedical Engineering (BME) have developed agreements (see attached) for revenue-sharing encompassing cross-enrollments of L&S and CoE, and SMPH and BME revenue program students respectively.

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.

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 latest scientific and technological advancements, advanced techniques, and modern engineering tools to address these problems
4. Demonstrate creative, independent problem solving skills
5. Recognize and apply principles of ethical and professional conduct

Method for assessing learning:
The faculty advisor will collect their advisees’ course work performance annually and compare with relationship chart between learning goals and the courses for assessment.

Plan for review of the assessment information:
The associate chair for graduate studies will provide assessment updates, keep track of the assessment timeline, and remind by email the faculty to collect their advisees’ 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 academic affairs committee for evaluation and further dissemination.

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 BME) with no option.

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 admissions criteria will be used for both the named option and the major. The Biomedical Engineering Department will make the final decision on all admissions to the option. The named option will admit students that meet the minimum English language 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?
We expect 20-30 students per year.

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?

Beyond 30 students, we would need to add additional sections to some courses and, at that
point, we would support additional faculty associates using revenue from this program. We
would then also need additional TAs.

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: Biomedical Engineering
   Named option advisor(s):
   Faculty: Beth Meyerand 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 an additional BME faculty member to work with the existing Associate
   Chair of graduate advising. Additionally, the students will have access to revenue-supported
   graduate services 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: Beth Meyerand and one additional faculty adviser to be named
Core Teaching faculty: Responsibilities will be shared among BME primary and teaching faculty
Administrative staff: Staff: Kelly Moran
Department of Biomedical Engineering

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 expense of hiring an additional Faculty Associate and two additional TA’s will be funded by program revenue. The expense of additional technology needs and instructional supplies, etc will also be funded by program revenue as well as Departmental funds as needed in the event some of these expenses overlap with other classes. The Program will be administered by the Graduate Program Director who is paid by department funds and therefore the expense for their work will not be covered by program revenue. Assessment will be addressed within Biomedical Engineering using the same process employed for the existing BME MS program.

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 option programs, so the cost to each program is minimal. Additional TAs and graders may be required to assist with individual courses. In some cases, new courses will be created and those costs will be born 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, program revenue will be used to fund 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
Curriculum for UW Master of Science Degree Program
Department of Biomedical Engineering

Degree/Major: M.S. in Biomedical engineering
Option: Accelerated Program
Credits Requirement: 30

Suggested Course Credit Allocation:

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td>12 Credits</td>
</tr>
<tr>
<td>Spring Semester</td>
<td>12 Credits</td>
</tr>
<tr>
<td>Summer Session</td>
<td>6 Credits</td>
</tr>
</tbody>
</table>

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Proposed Curriculum for Department of Biomedical Engineering

Option: Biomedical Engineering

Of the 30 credits counted towards the degree, at least 15 must be at the graduate level.

Required courses:

(1) At least 3 credits of a biological science, relevant options include:
- Biochem 501 (3 credits): Introduction to biochemistry (fall, spring)
- CRB 640 (3 credits): Fundamentals of stem cell and regenerative biology (spring)
- CRB 650 (3 credits): Molecular and cellular organogenesis (spring)
- NTP 610 (4 credits): Cellular and molecular neuroscience (fall)
- NTP 611 (4 credits): Systems Neuroscience (spring)
- NTP 735 (2 credits): Neurobiology of Disease (spring)
- ANAT&PHY 335 (5 credits): Physiology (fall)
- ANAT&PHY 435 (5 credits): Fundamentals of human physiology (spring)
- Zoo 523 (5 credits): Neurobiology (fall)
- Zoo 570 (3 credits): Cell biology (fall)
- Zoo 630 (3 credits): Cellular signal transduction methods (fall)

(2) At least 12 credits of engineering, relevant options include:
- BME 415 (3 credits): Biomechanics of human movement (fall)
- BME 430 (3 credits): Biological interactions with materials (spring)
- BME 462 (3 credits): Medical instrumentation (fall)
- BME 505 (3 credits): Biofluidics (spring)
- BME 510 (3 credits): Introduction to tissue engineering (fall)
- BME 511 (1 credit): Tissue engineering laboratory (fall)
- BME 520 (3 credits): Stem cell bioengineering (fall, spring)
- BME 530 (3 credits): Medical imaging systems (spring)
- BME 535 (3 credits): Intro to energy-tissue interactions (fall)
- BME 545 (3 credits): Engineering extracellular matrices (Spring)
- BME 550 (3 credits): Introduction to biological and medical microsystems (fall)
- BME 556 (3 credits): Systems biology: mammalian signaling networks (spring)
- BME 573 (3 credits): Medical image science: mathematical and conceptual foundations (fall)
- BME 574 (3 credits): Imaging in medicine: applications (spring)
- BME 578 (3 credits): Non-ionizing diagnostic imaging (spring)
- BME 615 (3 credits): Tissue mechanics (fall)
- BME 619 (3 credits): Microscopy of life (fall)
- BME 650 (3 credits): Optical microscopy (spring)
• CBE 540 (3 credits): Polymer science and technology (fall)
• CBE 560 (3 credits): Biochemical engineering (fall)
• ECE 524 (3 credits): Introduction to optimization (fall)
• ECE 533 (3 credits): Image processing (fall)
• ECE 539 (3 credits): Introduction to artificial neural network and fuzzy systems (fall)
• ME 563 (3 credits): Intermediate fluid mechanics (spring)
• ME 570 (3 credits): Experimental mechanics (fall)
• ME 573 (3 credits): Computational fluid dynamics (fall)
• MSE 521 (3 credits): Advanced polymer materials (fall)

(3) 2 semesters of BME 701 (0 credits): Biomedical Engineering seminar (fall, spring)

(4) Additionally, students are encouraged to pursue advanced courses in mathematics and data analysis
• BMI 541 (3 credits): Introduction to biostatistics (fall)
• COMP SCI 567 (3 credits): Medical image analysis (spring)
• COMP SCI 714 (3 credits): Methods of computational mathematics (fall)
• COMP SCI 765 (3 credits): Data visualization (fall)
• COMP SCI 766 (3 credits): Computer vision (spring)
• COMP SCI 767 (3 credits): Computational methods for medical image analysis (fall)
• MATH 443 (3 credits): Applied linear algebra (fall)
• MATH 519 (3 credits): Ordinary differential equations (spring)
• MATH 619 (3 credits): Analysis of PDE (spring)

The above classes are currently taught in either the fall or spring terms. Some popular classes are always full and given the resources, additional sections can be added in the summer. Immediately, students can pursue independent studies for summer credits.

We recognize that the course list is extensive, however, BME undergrads have a high number of required courses due to the intrinsically interdisciplinary nature of the degree. We prefer the students have significant options to better prepare themselves for the next career step. In order for the students to pick a plan of course work, each student will meet with an advisor who will work with them individually to make sure their plan is appropriate.
Biomedical Engineering

**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>Biomedical Engineering MS option</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>16 credits</td>
</tr>
<tr>
<td>Minimum Graduate Coursework (50%) Requirement</td>
<td>At least 50% of credits applied towards the graduate degree credit requirement must be in graduate-level coursework</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Prior Coursework Requirements: Graduate Work from Other Institutions</th>
<th>Prior Coursework Requirements: Graduate Work from Other Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>With program approval, students are allowed to count graduate coursework from other institutions toward the minimum graduate degree credit requirement and the minimum graduate coursework (50%) requirement. No credits from other institutions can be counted toward the minimum graduate residence credit requirement. Course work earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.</td>
<td>With program approval, students are allowed to count graduate coursework from other institutions toward the minimum graduate degree credit requirement and the minimum graduate coursework (50%) requirement. No credits from other institutions can be counted toward the minimum graduate residence credit requirement. Course work earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.</td>
</tr>
</tbody>
</table>

**Prior Coursework Requirements: UW-Madison Undergraduate**

<table>
<thead>
<tr>
<th>Prior Coursework Requirements: UW-Madison Undergraduate</th>
<th>Prior Coursework Requirements: UW-Madison Undergraduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>With program approval, students are allowed to count up to 7 credits numbered 300 or above graduate coursework from UW-Madison taken in excess of undergraduate degree requirements toward the minimum graduate degree credit requirement; if that coursework is numbered 700 or above it may be used to satisfy the minimum graduate coursework (50%) requirement. No credits can be counted toward the minimum graduate residence credit requirements. Course work earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.</td>
<td>With program approval, students are allowed to count up to 7 credits numbered 300 or above graduate coursework from UW-Madison taken in excess of undergraduate degree requirements toward the minimum graduate degree credit requirement; if that coursework is numbered 700 or above it may be used to satisfy the minimum graduate coursework (50%) requirement. No credits can be counted toward the minimum graduate residence credit requirements. Course work earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.</td>
</tr>
</tbody>
</table>

**Prior Coursework Requirement: UW-Madison University Special**

<table>
<thead>
<tr>
<th>Prior Coursework Requirement: UW-Madison University Special</th>
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</thead>
<tbody>
<tr>
<td>With program approval and payment of the difference in tuition (between Special and graduate tuition), students are allowed to count up to 15 credits of coursework numbered 300 or</td>
<td>With program approval and payment of the difference in tuition (between Special and graduate tuition), students are allowed to count up to 15 credits of coursework numbered 300 or</td>
</tr>
</tbody>
</table>

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above taken as a UW–Madison Special student toward the minimum graduate residence credit requirement and, the minimum graduate degree credit requirement; if that coursework is numbered 700 or above it may be used to satisfy, and the minimum graduate coursework (50%) requirement.

<table>
<thead>
<tr>
<th>Credits per Term Allowed</th>
<th>15 credits allowed per semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program-Specific Courses Required</td>
<td>No</td>
</tr>
<tr>
<td>Overall Graduate GPA Requirement</td>
<td>3.00</td>
</tr>
<tr>
<td>Other Grade Requirements</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>Probation Policy</td>
<td>Probation Policy 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>Advisor / Committee</td>
<td>Advisor / Committee Every graduate student is required to have an advisor. An advisor is a faculty member from the major department responsible for providing advice regarding graduate studies. In many cases, an advisor is assigned to incoming students. 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>Assessments and Examinations</td>
<td>No formal examination required.</td>
</tr>
<tr>
<td>Time Constraints</td>
<td>Time Constraints 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>Language Requirements</td>
<td>No language requirements.</td>
</tr>
</tbody>
</table>
**MS Assessment Plan**

**Identifying Information**
School/College: College of Engineering  
Graduate Degree/Major Program Name: Biomedical Engineering  
Graduate Degree Level (M.S., M.A., Ph.D., DMA, etc.): M.S.  
Faculty Director Contact/Title: Beth Meyerand, Associate Chair for Graduate Studies  
Primary Contact Information: memeyerand@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 latest scientific and technological advancements, advanced techniques, and modern engineering tools to these problems.
4. Demonstrate creative, independent problem solving skills.
5. 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 (at least one direct method required)</th>
</tr>
</thead>
</table>
| All learning goals        | 1. All graduating MS students will fill in a survey form to answer a series of questions pertaining to all of the learning goals such as if the student feels comfortable in problem solving related to Biomedical Engineering. Data from these self-reported measures will be compiled bi-annually and applied to the annual reports on specific learning goals (indirect measure).  
2. The list of all the courses taken by an MS student will be checked to make sure these learning goals are addressed in the courses taken according to the Curriculum Mapping Worksheet. The grades of these courses will be analyzed.  
3. Feedback from the course instructor may be requested to evaluate the student outcome for a course with less satisfactory grade.  
4. The course list in the Curriculum Mapping Worksheet will be reviewed and updated every three years by the Graduate Curriculum Committee. Specifically, the course content will be checked and... |
see if the corresponding learning outcomes can be sufficiently addressed by the content. If not, the check list will be updated accordingly.

Timetable for assessment activity (at least one activity each year; all goals reviewed in a 3-year cycle): All the goals will be assessed annually and the faculty advisor will provide a summary on the assessment results annually.

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 for graduate studies will provide assessment updates, keep track of the assessment timeline, and remind by email the faculty to collect their advisees’ 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 academic affairs committee for evaluation and further dissemination.

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):

   Annually, the academic affairs committee will review the assessment information and compile a summary report to be reviewed by all faculty during a department faculty meeting held early in the Fall of the academic year.

3. **What is the plan for the 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 "All Faculty" department meeting, the academic affairs committee will decide which (if any) items are actionable and provide a report of those plans, along with the initial assessment summary, to the Provost office by December 1st.

4. **How will recommendations be implemented?** (explain the general process by which recommendations will be implemented):

   Any actionable items will be discussed during curriculum committee meetings held in the Spring semester. If approved at that time, any curricular/programmatic/co-curricular changes will be implemented the following Fall semester or thereafter.
**Graduate Degree Program Curriculum Mapping Worksheet**

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.

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<th>Curriculum Map (Where)</th>
<th>Enter program-level learning goals and check (X) which course or experience contributes to which learning goal.</th>
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Draft Budget:

Average future enrollment: 20 students

Estimated annual tuition: $20,000 per student

Annual Revenue: $400,000

Annual University Assessment: $40,000

Annual Engineering College Assessment: $80,000*

Annual instructional costs:

2 TAs (salary and fringe) for 12 months: $27,890

.5 FTE Faculty Associate (salary and fringe): $50,000

Supplies/Technology: $25,000

Shared revenue with L&S: $36,000 **

Shared revenue with SMPH: $36,000**

Estimated excess tuition available for reinvestment: $105,110

*Estimated. Includes centralized administration, student services, marketing and recruitment.

**Estimated based on each student taking two 3 credit Non-Engineering courses at $600/credit
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:
   ☑ 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.
Memorandum of Agreement between the College of Letters & Science and the College of Engineering for 131 Program Revenue Sharing

April 30, 2018

While revenue-generating (fund 131) programs are intended to be largely self-contained (with the home department providing most of the instruction), program students may benefit from the opportunity to take courses in other departments or colleges. Because tuition paid by program students flows directly to the home department, this necessitates a revenue-sharing agreement with the department providing the instruction. To avoid the proliferation of bilateral agreements between departments, the College of Letters & Science (L&S) and the College of Engineering (CoE) have developed the present revenue-sharing agreement to encompass all cross-college enrollments of L&S and CoE program students.

Scope of this agreement:

- This agreement covers all enrollments of L&S program students in CoE courses, and all enrollments of CoE program students in L&S courses.
- This agreement covers all revenue-generating programs in both colleges: capstone programs, masters programs, and Visiting International Student Programs (VISPs).
- This agreement supersedes an earlier MOA to permit CoE program students to enroll in English as a Second Language (ESL) courses.

Revenue sharing:

- Toward the end of each fiscal year, the L&S Budget Office will use Credits-Follow-Instructor (CFI) data to determine the number of credits taken by L&S program students in CoE courses, and the number of credits taken by CoE program students in L&S courses.
- Both colleges will have an opportunity to review the CFI data and discuss corrections before any funds are transferred between colleges. To the extent that errors in CFI data stem from payroll errors (e.g., miscoding an instructional appointment as a research appointment), each college will work to eliminate these payroll errors going forward.
- All instruction is valued at $600 per credit.
- For administrative simplicity, the college responsible for taking the larger number of credits will make a single payment to the other college. For instance, if L&S program students took 300 credits in CoE courses, and CoE students took 180 credits in L&S courses, then L&S would transfer $600 * (300 – 180) = $72,000 to CoE. Conversely, CoE would pay L&S if CoE program students were responsible for more cross-college credits than L&S program students.
- Each college is responsible for internal fund transfers to or from its departments.

Consultation between colleges:

- When new programs are under consideration, the home college will contact the other college to request permission for cross-enrollments, providing curricular details and enrollment estimates to help the instructional departments assess the impact on their teaching capacity.
- Existing programs should notify instructional departments of any anticipated change in program enrollment as soon as possible, giving the instructional department time to adjust capacity.
- We anticipate that instructional departments will routinely grant requests for new or increased cross-enrollments, with the $600/credit payments being adequate to cover incremental costs. However, in exceptional circumstances, instructional departments will may prohibit or limit
cross-enrollments in cases where they lack adequate capacity. Timely communication between the programs and instructional departments about projected enrollments will be important, providing more time for instructional departments to increase capacity, and for programs to consider curricular alternatives when necessary.

- Unless otherwise agreed, the instructional department will determine if and when to offer courses following its usual scheduling practices. There is no obligation to teach additional or designated sections for program students.
- Further consultation between home and instructional departments will be undertaken as needed (e.g., regarding ESL placements of program students).

Period of agreement:

- This agreement will be effective for 2018-19 and 2019-20.
- In Spring 2020, L&S and CoE will discuss whether to continue or revise the terms of this agreement.

Signatures:

- College of Engineering ____ ____Date__5/2/2018___
- College of Letters & Science ____ ____Date____5/8/2018_____
Memorandum of Agreement between the School of Medicine and Public Health and the Department of Biomedical Engineering

April 20, 2018

Revenue-generating programs receive non-pooled tuition on fund 131. If students from a revenue-generating program take courses outside of their department, a Memorandum of Agreement (MOA) must be in place to specify obligations, expectations, and the terms for revenue sharing. This MOA addresses enrollment in School of Medicine and Public Health (SMPH) courses by 131 program students in the Department of Biomedical Engineering (BME) in the College of Engineering.

Course enrollments:

- BME program students may enroll in the following SMPH courses:
  - CRB 640, 650
  - NTP 610, 611, 635
  - Physiol 335, 445
  - BMI 541

- The SMPH departments will determine if and when to offer these courses following their usual scheduling practices; there is no obligation to teach additional or designated sections for the BME program students.

- The BME program projects annual enrollment of about 20-30 students per year. Relevant SMPH courses are suggested courses among many others, and enrollment by BME students in individual SMPH courses is not expected to be high.

Revenue sharing:

- The Department of Biomedical Engineering agrees to pay $600 per credit hour for SMPH courses taken by revenue-based BME program students.
- The Department of Biomedical Engineering will determine SMPH class enrollments annually toward the end of the fiscal year, and inform SMPH of the credit hours taken and the amount due for transfer.
- The Department of Biomedical Engineering will transfer revenue on fund 131 to the SMPH Budget Office, which will then make a transfer to the relevant SMPH departments.

Period of agreement:

- The first cohort will enter the BME Master’s program in fall 2019.
- This agreement be effective for 2019-20 and 2020-21.
- In Spring 2021, SMPH and the Department of Biomedical Engineering will discuss whether to continue or revise the terms of this agreement.

Signatures:

- BME Graduate Program Director  
  [Signature]  
  Date 6/14/18

- College of Engineering  
  [Signature]  
  Date 6/27/18

- SMPH Budget Office  
  [Signature]  
  Date 6/14/18
Biomedical Engineering Accelerated Program
20-30 students per year (estimated)

Curriculum for UW Master of Science Degree Program
Department of Biomedical Engineering

Credits Requirement: 30
Suggested Course Credit Allocation:
Fall Semester 12 Credits
Spring Semester 12 Credits
Summer Session 6 Credits

Of the 30 credits counted towards the degree, at least 15 must be at the graduate level.

Required courses:
(1) At least 3 credits of a biological science, relevant options include:
   • Biochem 501 (3 credits): Introduction to biochemistry (fall, spring)
   • CRB 640 (3 credits): Fundamentals of stem cell and regenerative biology (spring)
   • CRB 650 (3 credits): Molecular and cellular organogenesis (spring)
   • Genetics 466 (3 credits): General genetics (fall, spring)
   • NTP 610 (4 credits): Cellular and molecular neuroscience (fall)
   • NTP 611 (4 credits): Systems Neuroscience (spring)
   • NTP 635 (2 credits): Neurobiology of Disease (spring)
   • Physiol 335 (5 credits): Physiology (fall)
   • Physiol 445 (5 credits): Fundamentals of human physiology (spring)
   • Zoo 523 (5 credits): Neurobiology (fall)
   • Zoo 524 (5 credits): Neurobiology II: An introduction to brain and behavior (spring)
   • Zoo 570 (3 credits): Cell biology (fall)
   • Zoo 630 (3 credits): Cellular signal transduction methods (fall)

(2) At least 12 credits of engineering, relevant options include:
   • BME 415 (3 credits): Biomechanics of human movement (fall)
   • BME 430 (3 credits): Biological interactions with materials (spring)
   • BME 462 (3 credits): Medical instrumentation (fall)
   • BME 505 (3 credits): Biofluidics (spring)
   • BME 510 (3 credits): Introduction to tissue engineering (fall)
   • BME 511 (1 credit): Tissue engineering laboratory (fall)
   • BME 520 (3 credits): Stem cell bioengineering (fall, spring)
   • BME 530 (3 credits): Medical imaging systems (spring)
   • BME 535 (3 credits): Intro to energy-tissue interactions (fall)
   • BME 545 (3 credits): Engineering extracellular matrices (Spring)
   • BME 550 (3 credits): Introduction to biological and medical microsystems (fall)
   • BME 556 (3 credits): Systems biology: mammalian signaling networks (spring)
• BME 573 (3 credits): Medical image science: mathematical and conceptual foundations (fall)
• BME 574 (3 credits): Imaging in medicine: applications (spring)
• BME 578 (3 credits): Non-ionizing diagnostic imaging (spring)
• BME 615 (3 credits): Tissue mechanics (fall)
• BME 619 (3 credits): Microscopy of life (fall)
• BME 650 (3 credits): Optical microscopy (spring)
• CBE 540 (3 credits): Polymer science and technology (fall)
• CBE 560 (3 credits): Biochemical engineering (fall)
• ECE 462 (3 credits): Medical Instrumentation (fall)
• ECE 524 (3 credits): Introduction to optimization (fall)
• ECE 533 (3 credits): Image processing (fall)
• ECE 539 (3 credits): Introduction to artificial neural network and fuzzy systems (fall)
• ME 563 (3 credits): Intermediate fluid mechanics (spring)
• ME 570 (3 credits): Experimental mechanics (fall)
• ME 573 (3 credits): Computational fluid dynamics (fall)
• MSE 521 (3 credits): Advanced polymer materials (fall)

(3) 2 semesters of BME 701 (0 credits): Biomedical Engineering seminar (fall, spring)

(4) Additionally, students are encouraged to pursue advanced courses in mathematics and data analysis
  • BMI 541 (3 credits): Introduction to biostatistics (fall)
  • Comp Sci 367 (3 credits): Data structures (fall)
  • CS 567 (3 credits): Medical image analysis (spring)
  • CS 714 (3 credits): Methods of computational mathematics (fall)
  • CS 765 (3 credits): Data visualization (fall)
  • CS 766 (3 credits): Computer vision (spring)
  • CS 767 (3 credits): Computational methods for medical image analysis (fall)
  • MATH 443 (3 credits): Applied linear algebra (fall)
  • MATH 519 (3 credits): Ordinary differential equations (spring)
  • MATH 619 (3 credits): Analysis of PDE (spring)
### Net Tuition for Full-Time Students

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### Tuition Per Credit

- **Tuition per credit:** Students complete 30 credits in 3 sems (fall, spring, and summer) 80%
- Resident: $322
- Nonresident: $722
- % Nonres: 75%
- Weighted avg: $622 Round to $600/credit