

# *Biomedical Engineering*

## *The University of South Dakota*

### *Master's Graduate Program Guidelines*

The Biomedical Engineering (BME) Program at The University of South Dakota (USD) is a joint effort with The South Dakota School of Mines and Technology (SDSMT) in Rapid City, South Dakota. Students will register all their classes through USD but will have professors from both campuses. Some classes are taught via DDN (electronic distance learning) from our sister campuses. The BME program is under the Graduate School. The Program is based in Sioux Falls, SD and resides in the GEAR (Graduate Education & Applied Research) Center.

#### **The University of South Dakota Biomedical Engineering Program GEAR Center**

4800 N. Career Ave., Suite 221  
Sioux Falls, SD 57107  
605-367-7763 Fax: 605-782-3280  
BME email: [bme@usd.edu](mailto:bme@usd.edu)

Dan Engebretson, Ph.D. – BME Program Director  
Office phone: 605-367-7762  
Email: [Daniel.Engebretson@usd.edu](mailto:Daniel.Engebretson@usd.edu)

Yuyu Sun, Associate Professor  
Phone: 605-367-7776  
Email: [Yuyu.Sun@usd.edu](mailto:Yuyu.Sun@usd.edu)

Ying Deng, Assistant Professor  
Phone: 605-367-7775  
Email: [Ying.Deng@usd.edu](mailto:Ying.Deng@usd.edu)

Gopinath Mani, Ph.D.  
Phone: 605-367-7773  
Email: [Gopinath.Mani@usd.edu](mailto:Gopinath.Mani@usd.edu)

#### **The University of South Dakota Graduate Office**

414 East Clark  
Vermillion, SD 57069  
605-677-6287  
Email: [gradsch@usd.edu](mailto:gradsch@usd.edu)

Laurie Becvar, Dean  
Grad Office – USD  
Email: [Laurie.Becvar@usd.edu](mailto:Laurie.Becvar@usd.edu)

#### **South Dakota School of Mines Technology**

BME Program Director  
Rapid City, SD 57701  
(605) 394-5133  
Email:

Sookie Bang  
Email: [Sookie.Bang@sdsmt.edu](mailto:Sookie.Bang@sdsmt.edu)

#### **South Dakota State University**

Adam Hoppe  
Email: [Adam.Hoppe@sdstate.edu](mailto:Adam.Hoppe@sdstate.edu)

Ron Utecht  
Sioux Falls - PhotoBioMed  
Email: [Ronald.Utecht@sdstate.edu](mailto:Ronald.Utecht@sdstate.edu)

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# BME Program Guidelines

## I. Introduction

The Biomedical Engineering Program of The University of South Dakota, henceforth referred to as the BME Program, offers graduate programs leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.). Courses, seminars, research experiences and conferences stress both classical and contemporary approaches to graduate training. In addition, the program is designed to provide opportunities for teamwork, open-ended problem solving and critical thinking. **This document details the guidelines for the M.S. graduate program.**

Program requirements reflect a research-oriented program in which the student will develop scientific interests, capabilities, and research potential. The student-to-faculty ratio is low, which facilitates personal and informal interaction between students and faculty. The M.S. degree is awarded to individuals who have completed the requirements of the appropriate degree program and have demonstrated the ability to conduct independent research.

## II. Admission Requirements –

- A. General Requirements: The USD Graduate School has the overall responsibility for admissions to graduate programs at the University of South Dakota. Admission to the BME graduate program is contingent upon satisfying the admission requirements of the Graduate School of the University of South Dakota and those of the BME Program. The minimum standard for admission to the University is an undergraduate grade point average of 2.70 on a 4.00 scale. The applicant must have an adequate background in biomedical engineering or an appropriate closely related field. In most instances, candidates for admission who have earned a bachelor's degree in biomedical engineering or a closely related field possess adequate preparation for the graduate program. It is highly recommended that candidates that do not have a bachelor's degree in an engineering discipline have a strong background in mathematics that includes coursework up to and including Calculus III or its equivalent. Appropriate courses may need to be taken by the applicant to remove any academic deficiencies. A Graduate Record Examination (GRE) is required.

The BME Program encourages all applicants to have their completed application submitted to the BME Program by January 1 of the calendar year they wish to enter the program. Applications are reviewed by the BME Program's Graduate Committee (hereafter referred to as the Graduate Committee) until approximately March 1st. Positions are limited and are filled as qualified applicants are identified. Applications received after March 1st will be reviewed only if a graduate student vacancy in the program exists.

Applicants who are not citizens or permanent residents of the United States must have their applications complete no later than February 15th. This will allow sufficient time for the application to be reviewed and, upon acceptance to the program, for required documentation to be processed in a timely manner. Failure to allow sufficient time for all documentation to be processed may result in the successful applicant having to delay entrance into the program for up to one calendar year.

A laptop or a desktop computer is highly recommended to complete your BME studies.

Initial correspondence concerning application for admission to the graduate program should be addressed to the Graduate School of The University of South Dakota, Biomedical Engineering Program, 414 East Clark Street, Vermillion, South Dakota 57069-2390. A link to the official application form is available on the USD Graduate School's website ([www.usd.edu/graduate](http://www.usd.edu/graduate)) or on the BME Program website ([www.usd.edu/gradsch/degreeProgs/biomedical\\_engineering.cfm](http://www.usd.edu/gradsch/degreeProgs/biomedical_engineering.cfm)).

### III. Student Guidance and Selection of Advisors

- A. Temporary Advisors Upon admission to the program, the Program Director will act as or appoint a temporary advisor to the student. The temporary advisor will assist the student in selection of course work and will monitor the student's progress until an Advisor and Advisory Committee are selected.
- B. Advisor and Dissertation Students seeking a M.S. degree should select an Advisor no later than the end of 1<sup>st</sup> semester. The final decision to accept the student as an advisee rests with the faculty member with the advice and consent of the BME Chair. The Advisor supervises and coordinates the student's research and selection of appropriate course work. Students may change their advisor by obtaining permission from the BME Chair and the new advisor.

In conjunction with the Advisor and in consultation with the BME Chair, the student will decide on the formation of an Advisory Committee. For M.S. Students a minimum of two (2) faculty members plus the student's advisor are required for the advisory committee. One member of the advisory committee must be from the student's research area and at least one member must be from outside the student's research area or the BME Program. In accordance with the guidelines of the Graduate School, membership on the Advisory Committee is limited to Graduate Faculty of The University of South Dakota. The Advisory Committee should be constituted by the end of the student's first semester.

The BME Master's Program is intended to be a two year study program, however, the program allows for thesis completion within seven years from the date of admission. If the student's research and thesis are not completed within seven years from the date of admission to the BME Master's Program a degree will not be granted. The student must submit a completed thesis to the Advisory Committee written in a style approved by the Advisory Committee and consistent with the guidelines of the Graduate School. The completed thesis must be presented to the Advisory Committee a minimum of ten working days prior to the oral thesis defense. The student may defend the thesis only after it has been accepted by the Advisory Committee.

Summary guidelines for the Advisory Committee:

- (1) The committee is to meet at least once each semester. A formal Committee Meeting will take place within three weeks of the end of the Fall and Spring semesters.
  - (2) The committee members are expected to be available to help the student solve research problems.
  - (3) The student is expected to submit a written progress report to each committee member prior to each formal committee meeting.
  - (4) The Committee is responsible for reviewing the scientific merit of the thesis research and for final approval of the dissertation.
- C. Review of Student's Performance Student performance is evaluated each semester through progress reporting and formal committee meetings. A student's Advisor and Advisory Committee will evaluate the student's accomplishments in academics, research and overall progress toward the degree. Students are to prepare their progress reports each semester and forward them to the Program Chair and their Advisory Committee members for review at least three days before their scheduled committee meeting. The results of the review and evaluation will form the basis for BME Program recommendations concerning the continuation of the student in the program and future academic course work and research involvement. The student will be informed after their bi-annual committee meeting of the results of this review, and a

summarized copy of the review will become part of the student's permanent record on file in the BME Program Office. The student may review the evaluation with the BME Chair and their Advisor.

- D. Academic Probation In order to remain in good standing, a student must maintain a "B" average or 3.00 on a 4.00 scale. The "B" average is the average of all non-research, non-seminar course work. As such, a student is not allowed to correct academic deficiencies with "A" grades in research or seminar. No grade below a "C" is acceptable for graduate work. If the cumulative average falls below 3.00, the student is placed on academic probation. The student may be removed from academic probation by repeating the course or courses and/or taking other courses that will restore the average to 3.00 or higher. The Graduate Committee must approve the proposed course registration of any student on academic probation. If a student fails to raise the cumulative average to 3.00 within one academic year, the student may be dismissed from the program. A student on academic probation will not be permitted to defend their dissertation or thesis. A graduate grade point average, inclusive of research and seminar grades, of at least 3.00 is required for graduation.

Student's receiving research or teaching fellowships/assistantships must maintain a 3.0 grade point average to receive the fellowship/assistantship and qualify for a reduction in tuition. Students on academic probation may not receive a fellowship/assistantship unless recommended by the Graduate Committee

- E. Research Probation In order to remain in good standing, a student must be actively involved in research at least 20 hours per week, be making adequate progress in their research, attending team meetings and making the benchmarks outlined for the program. If a student is not meeting the criteria outline, they will be put on Research Probation and required to meet with their Advisory Committee at least twice a semester to assess their research deficiencies. The student will have one semester to meet the benchmarks or he/she will be dismissed from the program. A student on research probation will not be permitted to defend his/her dissertation or thesis.

Students receiving research or teaching fellowships/assistantships must meet or exceed the research criteria outlined to receive the fellowship/assistantship and qualify for a reduction in tuition. Students on research probation may not receive a fellowship/assistantship unless recommended by the Graduate Committee.

- F. Grievance Procedure The grievance procedure of the BME Program is in keeping with the policy stated in the *Catalogue of Graduate Programs*.

#### **IV. Degree Requirements for the BME Master's Program**

- A. Course Requirements Students entering the BME Program take coursework from the required BME courses listed below and select with their advisor additional courses from the electives to complete their BME discipline (36 hours for M.S. Students; 86 hours for Ph.D. Students). Up to 21 credits of prior graduate level coursework may be applied toward the Ph.D. program at the discretion of the student's advisory committee.

Biomedical Engineering is an extremely broad discipline. A consequence of this breadth is that it is difficult to define a set of core courses that will satisfy the needs of all students. In USD's program, we have identified a short list of courses that we believe are essential for all students, and this list is enumerated below. In addition to the listed courses, a graduate student's advisor as well as his/her advisory committee may require that a student take other courses (from Biomedical Engineering and other disciplines as appropriate) that are relevant to the student's research or career goals.

### **Master's Program**

BME 601	Biomaterials	3 credits
BME 602	Anatomy & Physiology for Engineers	3 credits
BME 603	Molecular Biology for Engineers	3 credits
BME 608	Biomedical Engineering	3 credits
BME 610	Experimental Design & Analysis	3 credits
BME 790	Seminar	3 credits
BME 798	Master's Thesis	6 credits
	<u>Approved Electives</u>	<u>9 credits</u>
	Total	33 credits

### **Ph.D. Program**

BME 601	Biomaterials	3 credits
BME 602	Anatomy & Physiology for Engineers	3 credits
BME 603	Molecular Biology for Engineers	3 credits
BME 608	Biomedical Engineering	3 credits
BME 610	Experimental Design & Analysis	3 credits
BME 790	Seminar	6 credits
BME 898	Dissertation	30 credits
	<u>Approved Electives</u>	<u>33 credits</u>
	Total	84 credits

The student, in consultation with the Advisor and Advisory Committee, will select the remainder of the credit hours required for graduation. Research areas within the BME Program may require additional coursework toward their Master's or Ph.D. degree. These requirements must be reviewed and approved by the Graduate Committee. The exact nature of the curriculum is determined by the specific area(s) of interest and benefit to the individual student and hence will vary from student to student.

Failure to earn a "B" or better in those courses representing the core program of study for the student will result in academic probation or the student's dismissal from the program. The Graduate Committee in consultation with the student's Advisor will make the determination regarding academic probation or dismissal.

#### B. Other Requirements

1. Teaching Requirements at this time (July '11) there are no teaching requirements for students, however in the future there may be.
2. Student Progress Reports. At the end of the Fall and Spring semesters, students are required to complete and submit a *Student Progress Report*, a *Research Summary* that describes the research they accomplished that semester and a *Research Objective Summary* that describes their research plan for the upcoming semester. Prior to submission of these reports and summaries to the BME Office they must be signed by the student's primary advisor. Students are to have Progress Reports, Research Summaries and Objectives submitted to the BME secretary no later than one week following the end of the semester. (Format requirements are available on BME Sharepoint).

3. Seminar

The BME Seminar Program is intended to introduce students to a wide variety of topics in biomedical engineering and to enhance student's skills in public presentations. The Seminar also serves as a comprehensive evaluation of a student's broader understanding of biomedical engineering. Seminar is divided into two main components: Presentations & Abstracts. **M.S. Students** will be required to enroll for 3 credits (semesters); however, to broaden your scientific knowledge in BME it is highly recommended that you regularly attend Seminar even if you are not enrolled.

Students please enroll or attend as described below:

Year 1	Fall Semester	Attend seminar
Year 1	Spring Semester	Enroll in seminar
Year 2	Fall & Spring Semester	Enroll in seminar

*Presentations*

Students must be enrolled in the seminar course the semester of their presentation.

In the first year (Spring semester), the presentation can be based on a BME topic of interest and does not have to be relevant to a student's research.

The second year (Fall & Spring semesters), two presentations will be made. The fall semester of the second year, the presentation can be on a BME topic of interest or a student's research area. The spring semester of the second year the presentation must be on the student's research area.

*Abstracts*

For semesters that the student is enrolled in Seminar they must submit six written abstracts on six of the seminar presentations. The presentations are to be chosen with input from the student's advisor. The abstract should summarize the presented research given during the seminar presentation. Abstracts will only be accepted within 2 weeks of any given seminar. Format requirements for Seminar Abstracts are available on BME Sharepoint.

4. Research Proposal By the end of a student's first year in the BME M.S. Program he/she must have prepared and had their Research Proposal approved by their Advisory Committee. A copy of the approved research proposal is to be submitted to the BME Program Office for placement in the Student's Personnel File. The research proposal is to be prepared using the format of a research application template from a national funding agency such as National Institutes of Health or National Science Foundation (A student's Advisor will provide guidance on appropriate format). The research project should be formulated in such a way that the research, preparation and defense of the dissertation can be completed within a reasonable period. Furthermore, the project must be of sufficient merit to warrant publication in a refereed journal.
5. Thesis Defense A candidate for the Master's degree must present an acceptable thesis from his/her major field. The thesis should demonstrate that the candidate has technical competence in the field and has done independent research. The results must add to or modify what was previously known or present a significant interpretation of the subject based upon original investigation.

The final thesis defense is conducted by the Advisory Committee. It is the privilege of the Dean of the USD Graduate School to appoint additional members to the Advisory Committee prior to the review of the defense. At that time, the membership of the Advisory Committee will be formally approved by the Dean of the USD Graduate School and the student will be certified by the Advisory

Committee to the USD Graduate School as ready to defend the thesis. A copy of the abstract of the thesis should accompany this certification. Completed copies of the thesis must be distributed to the Advisory Committee at least ten working days before the defense. An additional copy of the thesis must be on file in the BME Program Office to allow non-Committee members to review the thesis prior to the defense. It is the student's responsibility to furnish these copies. The time and place of the examination are established by the Advisor, who normally serves as Chair of the Committee. Immediately prior to the thesis defense, the student will present a formal seminar open to the public describing the thesis project. The announcement of this public seminar shall include an abstract of the thesis. This seminar, an overview of the thesis project, should not exceed one hour in length. After the presentation, the Advisory Committee will orally examine the student regarding the portion of the candidate's field of specialization in which the thesis falls (although the examination need not be confined exclusively to the subject matter of the thesis). The oral examination will be open to members of the Graduate Faculty. Participation in this examination, however, shall require the consent of the Chair of the Advisory Committee, the Graduate Committee or Dean of the USD Graduate School. The Advisory Committee decides if the student has satisfactorily defended their thesis. No student shall be considered to have passed the thesis defense with more than one dissenting vote.

At least one manuscript from the thesis project with the student as an author must be accepted for publication in a peer reviewed journal before the student is awarded the degree. Copies of all manuscripts (published, in press, or in review) shall be appended to the graduate thesis for review and approval by the Advisory Committee. Under extraordinary circumstances, the Graduate Committee can authorize a waiver to this requirement.

## **V. Graduate Fellowships/Assistantships**

When available, graduate teaching and research fellowships/assistantships will be offered to students on a competitive basis. The fellowships/assistantships provide a stipend and a reduction in tuition for the student. Students accepted to the program with provisional status or assigned probationary status shall not be eligible for a stipend or reduced tuition. Students provided a fellowship/assistantship should complete all coursework according to schedule. Students provided a research fellowship/assistantship, the most common fellowship/assistantship in the BME Program, are expected to work at least 20 hours each week in a research laboratory in addition to time spent in class. If you are supported as a Graduate Research Assistant during the summer, you must enroll for at least 1 credit of dissertation. Stipends are not guaranteed each year. The student must meet assistantship requirements and sign a Graduate Assistantship Acceptance each year.

## **VI Notice of Nondiscriminatory Policy**

Federal Law prohibits discrimination on the basis of disability (Section 504 of the Rehabilitation Act of '973 and Title II of the Americans with Disabilities Act). The University has designated Ms. Roberta Ambur, Vice President of Administration & ITS, as the Coordinator to monitor compliance with these statutes. Section 504 obligates USD and Ms. Ambur to provide equal access for all persons with disabilities. Ms. Ambur can be reached at Room 209, Slagle Hall, Phone: 605-677-5661.

## Benchmarks of the BME M.S. Program

It is anticipated that the BME M.S. Program will be a 2-year study program. One Thesis must be completed within 7 years of admission to the program in order to get a Master's Degree. The benchmarks listed below are minimums for the BME Master's Program. Individual research groups may require higher benchmarks.

Each Semester	<ul style="list-style-type: none"> <li>• Maintain a grade point average of 3.0 out of 4.0., excluding research grades.</li> <li>• Maintain adequate research benchmarks.</li> <li>• Attend seminar. See <i>Seminar</i> section of handbook for enrollment requirements.</li> <li>• Meet with your Advisor; determine individualized required courses and research for your discipline.</li> <li>• Your Formal Committee Meeting</li> <li>• Submit your written <i>Student Progress Report, Research Summary &amp; Research Objectives</i> to your Advisory Committee members &amp; the BME Program Office prior to each Formal Committee Meeting.</li> </ul>
End of 1 <sup>st</sup> semester	<ul style="list-style-type: none"> <li>• Students should select an Advisor no later than the end of 1<sup>st</sup> semester.</li> <li>• Submission of a <i>Proposed Program of Study</i> to Advisory Committee and approved by Program Director. Required form is available in the BME Office.</li> </ul>
Year 1	<ul style="list-style-type: none"> <li>• The Program Director will be each student's initial advisor.</li> <li>• Present a seminar second semester on a BME topic of interest.</li> </ul>
End of 1 <sup>st</sup> year	<ul style="list-style-type: none"> <li>• Preparation, review, presentation and approval of Research Proposal by your Advisory Committee. Copy of approved proposal placed in student's personnel file.</li> </ul>
Year 2	<ul style="list-style-type: none"> <li>• Present a seminar each semester on your area of research.</li> </ul>
Before Graduation	<ul style="list-style-type: none"> <li>• At least one original research paper must be accepted by the student, in press or published.</li> </ul>
Within 7 years of admission into the BME Program	<ul style="list-style-type: none"> <li>• Thesis paper submitted to the Advisory Committee ten days before Thesis Defense.</li> <li>• Submit a bound copy of your thesis.</li> <li>• Successfully defend your thesis.</li> <li>• Degree completion.</li> </ul>

## Benchmarks of the BME Ph.D. Program

It is anticipated that the BME Program will be a 5-year study program. There are Graduate School imposed time limits for a Ph.D. degree. All requirements must be completed within 5 years following the date of admission to Ph.D. candidacy. By special permission of the Graduate Dean, the time may be extended. One's Dissertation must be completed within 5 years of admission into the program in order to get a Ph.D degree. The benchmarks listed below are minimums for the BME Ph.D. Program. Individual research groups may require higher benchmarks.

Admission into the BME Program	<ul style="list-style-type: none"> <li>Graduate School and BME Program Requirements must be met.</li> </ul>
Each Semester	<ul style="list-style-type: none"> <li>Maintain a grade point average of 3.0 out of 4.0., excluding research grades.</li> <li>Maintain adequate research benchmarks.</li> <li>Attend seminar. See <i>Seminar</i> section of handbook for enrollment requirements.</li> <li>Meet with your Advisor; determine individualized required courses and research for your discipline.</li> <li>Formal Committee Meeting</li> <li>Submit your written <i>Student Progress Report, Research Summary &amp; Research Objectives</i> to your Advisory Committee members &amp; the BME Program Office prior to each Formal Committee Meeting.</li> </ul>
End of 1 <sup>st</sup> semester	<ul style="list-style-type: none"> <li>Submission of a <i>Proposed Program of Study</i> to Advisory Committee and approved by Program Director. Required form is available in the BME Office.</li> </ul>
Year 1	<ul style="list-style-type: none"> <li>The Program Director will be each student's initial advisor.</li> <li>Present a seminar on a BME topic of interest.</li> </ul>
End of Year 1	<ul style="list-style-type: none"> <li>Selection of Advisor approved by the Program Director.</li> </ul>
Year 2	<ul style="list-style-type: none"> <li>Present a seminar(s) on a BME topic of interest or on your area of research.</li> </ul>
Start of 4 <sup>th</sup> Semester	<ul style="list-style-type: none"> <li>Selection of Advisory Committee.</li> </ul>
End of Year 2	<ul style="list-style-type: none"> <li>Preparation, review, presentation and approval of Research Proposal by your Advisory Committee. Copy of approved proposal placed in student's personnel file.</li> <li>Second Year Oral Exam</li> </ul>
Year 3	<ul style="list-style-type: none"> <li>Present a seminar(s) on your area of research.</li> </ul>
End of Year 3	<ul style="list-style-type: none"> <li>A grant application to USD Graduate School completed and submitted.</li> </ul>
Year 4	<ul style="list-style-type: none"> <li>Present a seminar(s) on your area of research.</li> </ul>
Year 5	<ul style="list-style-type: none"> <li>Present a seminar(s) on your area of research.</li> </ul>
Before graduation	<ul style="list-style-type: none"> <li>At least one original research paper must be accepted by the student, in press or published.</li> <li>Complete and submit an external grant application.</li> </ul>
Within 5 years of admission into the BME Program	<ul style="list-style-type: none"> <li>Dissertation paper submitted to the Advisory Committee ten days before dissertation defense.</li> <li>Successfully defend your Dissertation.</li> <li>Submit a bound copy of your Dissertation.</li> <li>Degree completion.</li> </ul>