BIOMEDICAL ENGINEERING: BIOMEDICAL INNOVATION, DESIGN, AND ENTREPRENEURSHIP, MS

This is a course-based named option within the Biomedical Engineering MS (http://guide.wisc.edu/graduate/biomedical-engineering/biomedical-engineering-ms/).

The Biomedical Innovation, Design, and Entrepreneurship named option in the Biomedical Engineering MS program is designed to provide additional graduate-level, project-based experiences in design, prototyping, and manufacturing, as well as an understanding of business fundamentals, entrepreneurship, and project management. Upon completion, students will be prepared for careers at the interface of engineering and business.

ADMISSIONS

ADMISSIONS

Please consult the table below for key information about this degree program's admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program's website.

Graduate admissions is a two-step process between academic programs and the Graduate School. ***Applicants must meet* the minimum requirements *(https://grad.wisc.edu/apply/requirements/) of the Graduate School as well as the program(s).*** Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/apply/).

Requirements	Detail
Fall Deadline	December 15*
Spring Deadline	September 1 for international applicants; November 1 for domestic applicants
Summer Deadline	December 15
GRE (Graduate Record Examinations)	Not required.
English Proficiency Test	Every applicant whose native language is not English, or whose undergraduate instruction was not exclusively in English, must provide an English proficiency test score earned within two years of the anticipated term of enrollment. Refer to the Graduate School: Minimum Requirements for Admission policy: https://policy.wisc.edu/library/UW-1241 (https://policy.wisc.edu/library/UW-1241/).
Other Test(s) (e.g., GMAT, MCAT)	n/a
Letters of Recommendation Required	3**

* Fall application deadline: Rolling admission will begin after October 1, with a final application deadline of April 15 (as space allows).

** Not required for applicants with a UW–Madison Biomedical Engineering bachelor's degree.

Applicants should have a bachelor's degree in engineering (biomedical, chemical, electrical, industrial, mechanical, etc.) or science (biology, biochemistry, chemistry, genetics, immunology, physics, etc.). Each application is judged on the basis of:

- Official academic transcripts
- English proficiency test scores (https://grad.wisc.edu/apply/requirements/#english-proficiency) (if applicable)
- Three letters of recommendation
  - For applicants with a UW–Madison Biomedical Engineering bachelor's degree, these are not required.
- Statement of purpose (https://grad.wisc.edu/apply/prepare/)
- Resume

All applicants must satisfy requirements that are set forth by the Graduate School (https://grad.wisc.edu/). Applicants admitted to the program may be required to make up deficiency course requirements.

To apply to the Biomedical Engineering program, the online applications (https://grad.wisc.edu/apply/) including supportive materials, must be submitted as described below and received by the deadline.

OFFICIAL ACADEMIC TRANSCRIPT

Electronically submit one copy of your transcript of all undergraduate and previous graduate work in your online application to the Graduate School. Unofficial copies of transcripts will be accepted for review. Official copies are required after an applicant is recommended for admission. Please do not send transcripts or any other application materials to the Graduate School or the Biomedical Engineering department unless requested. If you have questions, please contact bmegradadmission@engr.wisc.edu.

ENGLISH PROFICIENCY TEST SCORES (IF APPLICABLE)

International degree-seeking applicants must prove English proficiency. Refer to the Graduate School's requirements (https://grad.wisc.edu/apply/requirements/).

THREE LETTERS OF RECOMMENDATION

These letters are required from people who can accurately judge the applicant's academic or research performance. Letters of recommendation are submitted electronically to graduate programs through the online application. Applicants should not send any more than three letters (if more than three are sent, only the first three will be considered). See the Graduate School for FAQs (https://grad.wisc.edu/apply/) regarding letters of recommendation. Recommendation letters are not required for applicants with a UW–Madison Biomedical Engineering bachelor's degree

STATEMENT OF PURPOSE

In this document, applicants should explain why they want to pursue further education in Biomedical Engineering. See the Graduate School for more advice on how to structure a personal statement (https://grad.wisc.edu/apply/prepare/).

RESUME

Upload your resume in your application.

APPLICATION FEE

Submission must be accompanied by the one-time application fee. It is non-refundable and can be paid by credit card (Master Card or Visa). This fee cannot be waived or deferred. Fee grants (https://grad.wisc.edu/apply/fee-grant/) are available through the Graduate School under certain conditions.

FUNDING

FUNDING

GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding/) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

PROGRAM INFORMATION

Students enrolled in this program are not eligible to receive tuition remission from graduate assistantship appointments at this institution.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

NAMED OPTION REQUIREMENTS

MODE OF INSTRUCTION

Face to Face	Evening/ Weekend	Online	Hybrid	Accelerated
Yes	No	No	No	Yes

Mode of Instruction Definitions

Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

Evening/Weekend: Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

Face-to-Face: Courses typically meet during weekdays on the UW-Madison Campus.

Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.

Online: These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

CURRICULAR REQUIREMENTS

Requirement	Detail
Minimum Credit Requirement	30 credits
Minimum Residence Credit Requirement	16 credits
Minimum Graduate Coursework Requirement	15 credits must be graduate-level coursework. Refer to the Graduate School: Minimum Graduate Coursework (50%) Requirement policy: https://policy.wisc.edu/library/UW-1244 (https://policy.wisc.edu/library/UW-1244/).
Overall Graduate GPA Requirement	3.00 GPA required. Refer to the Graduate School: Grade Point Average (GPA) Requirement policy: https://policy.wisc.edu/library/UW-1203 (https://policy.wisc.edu/library/UW-1203/).
Other Grade Requirements	n/a
Assessments and Examinations	There are no degree-specific assessments and examinations outside of those given in individual courses.
Language Requirements	n/a

REQUIRED COURSES

Code	Title	Credits
2 semesters of B M E 701		**2**
Engineering courses in design, prototyping and manufacturing [1]		**9**
B M E/E C E 462	Medical Instrumentation	
B M E/E C E 463	Computers in Medicine	
B M E 511	Tissue Engineering Laboratory	
B M E 601	Special Topics in Biomedical Engineering (Design for Rehabilitation)	
B M E 602	Special Topics in Biomedical Engineering (CRISPR Genome Editing and Engineering Laboratory)	
B M E 602	Special Topics in Biomedical Engineering (Microfluidics and Rapid Prototyping)	
B M E 603	Special Topics in Bioinstrumentation and Medical Devices	
B M E/I SY E 662	Design and Human Disability and Aging	
M E 449	Redesign and Prototype Fabrication	
M E 549	Product Design	

M E/I SY E 641	Design and Analysis of Manufacturing Systems	
I SY E 415	Introduction to Manufacturing Systems, Design and Analysis	
I SY E 517	Decision Making in Health Care	
I SY E 552	Human Factors Engineering Design and Evaluation	
I SY E 557	Human Factors Engineering for Healthcare Systems	
I SY E 602	Special Topics in Human Factors	
I SY E 603	Special Topics in Engineering Analytics and Operations Research	
I SY E 604	Special Topics in Manufacturing and Supply Chain Management	
I SY E 606	Special Topics in Healthcare Systems Engineering	
INTEREGR 477	Tools for Prototyping and Manufacturing	
General business, entrepreneurship and strategic innovation courses		**6**
Must include at least one of the following two B M E courses:		
B M E 640	Medical Devices Ecosystem: The Path to Product	
B M E 740	Biomanufacturing Entrepreneurship	
GEN BUS 310	Fundamentals of Accounting and Finance for Non-Business Majors	
GEN BUS 311	Fundamentals of Management and Marketing for Non-Business Majors	
M H R/A A E 540	Intellectual Property Rights, Innovation and Technology	
M H R 715	Strategic Management of Innovation	
M H R 722	Entrepreneurial Management	
M H R 734	Venture Creation	
M H R 738	Weinert Applied Ventures in Entrepreneurship (WAVE)	
R M I 650	Sustainability, Environmental and Social Risk Management	
Other technical elective engineering courses [1]		**0-6**
B M E/M E 415	Biomechanics of Human Movement	
B M E/ PHM SCI 430	Biological Interactions with Materials	
B M E/M E 505	Biofluidics	
B M E 510	Introduction to Tissue Engineering	
B M E 520	Stem Cell Bioengineering	
B M E/ MED PHYS 535	Introduction to Energy-Tissue Interactions	
B M E 545	Engineering Extracellular Matrices	
B M E 550	Introduction to Biological and Medical Microsystems	
B M E 556	Systems Biology: Mammalian Signaling Networks	
B M E/CBE 560	Biochemical Engineering	
B M E/ MED PHYS 573	Mathematical Methods in Medical Physics	
B M E/ MED PHYS 574	Data Science in Medical Physics	
B M E/ MED PHYS 578	Non-Ionizing Diagnostic Imaging	
B M E/M E 615	Tissue Mechanics	
B M E/ MED PHYS/ PHMCOL-M/PHYSICS/ RADIOL 619	Microscopy of Life	
B M E/CHEM/ MED PHYS 750	Biological Optical Microscopy	
B M E/E C E/ MED PHYS 778	Machine Learning in Ultrasound Imaging	
CBE 540	Polymer Science and Technology	
E C E/COMP SCI/ I SY E 524	Introduction to Optimization	
E C E/ COMP SCI 533	Image Processing	
E C E/COMP SCI/ M E 539	Introduction to Artificial Neural Networks	
I SY E 515	Engineering Management of Continuous Process Improvement	
M E 514	Polymer Additive Manufacturing	
M E 563	Intermediate Fluid Dynamics	
M E/E M A 570	Experimental Mechanics	
M E 573	Computational Fluid Dynamics	
M E 748	Optimum Design of Mechanical Elements and Systems	
M S & E 521	Advanced Polymeric Materials	
MED PHYS/ PEDIAT 705	Women and Leadership: Science, Health and Engineering	
Advanced design or research project		**3-6**
B M E 799	Advanced Independent Study	
Additional credits taken from the list above, chosen in consultation with advisor		**0-6**
Total Credits		**30**

[1] At least 6 credits in "Engineering courses in design, prototyping, manufacturing" and/or "Technical elective engineering courses" need to be from biomedical engineering courses.

Students in this program may not take courses outside the prescribed curriculum without faculty advisor and program director approval. Students in this program cannot enroll concurrently in other undergraduate or graduate degree programs.

POLICIES

GRADUATE SCHOOL POLICIES

The Graduate School's Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy/) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree

program faculty. Policies set by the academic degree program can be found below.

NAMED OPTION-SPECIFIC POLICIES

PRIOR COURSEWORK

Graduate Credits Earned at Other Institutions

Refer to the Graduate School: Transfer Credits for Prior Coursework (https://policy.wisc.edu/library/UW-1216/) policy. Contact the Graduate Coordinator for more information.

Undergraduate Credits Earned at Other Institutions or UW-Madison

A student who has completed their bachelor's degree at UW-Madison may transfer 6 credits of coursework with program approval. These courses must be engineering or advanced biological sciences coursework numbered 400 or above. Credits earned at other institutions are not allowed to transfer. Coursework earned ten or more years prior to admission to a master's degree is not allowed to satisfy requirements. These courses may not be used to satisfy the Graduate School's minimum residence credit requirement.

Credits Earned as a Professional Student at UW-Madison (Law, Medicine, Pharmacy, and Veterinary careers)

Refer to the Graduate School: Transfer Credits for Prior Coursework (https://policy.wisc.edu/library/UW-1216/) policy.

Credits Earned as a University Special Student at UW–Madison

Refer to the Graduate School: Transfer Credits for Prior Coursework (https://policy.wisc.edu/library/UW-1216/) policy. Contact the Graduate Coordinator for more information.

PROBATION

Refer to the Graduate School: Probation (https://policy.wisc.edu/library/UW-1217/) policy.

ADVISOR / COMMITTEE

Every biomedical engineering graduate student must have a faculty advisor. A faculty advisor provides the graduate student with academic guidance in their course program and research oversight in their thesis, project, or engineering report. Graduate students should always seek advice from their advisor and other faculty in their interest area prior to enrolling for courses.

CREDITS PER TERM ALLOWED

15 credits maximum

TIME LIMITS

The Biomedical Engineering MS Biomedical Innovation, Design, and Entrepreneurship program is typically completed in less than 18 months.

Refer to the Graduate School: Time Limits (https://policy.wisc.edu/library/UW-1221/) policy.

GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting (https://doso.students.wisc.edu/bias-or-hate-reporting/)
- Graduate Assistantship Policies and Procedures (https://hr.wisc.edu/policies/gapp/#grievance-procedure)
- Hostile and Intimidating Behavior Policies and Procedures (https://hr.wisc.edu/hib/)
  - Office of the Provost for Faculty and Staff Affairs (https://facstaff.provost.wisc.edu/)
- Employee Assistance (http://www.eao.wisc.edu/) (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (https://employeedisabilities.wisc.edu/) (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (https://grad.wisc.edu/) (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (https://compliance.wisc.edu/) (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office Student Assistance and Support (OSAS) (https://osas.wisc.edu/) (for all students to seek grievance assistance and support)
- Office of Student Conduct and Community Standards (https://conduct.students.wisc.edu/) (for conflicts involving students)
- Ombuds Office for Faculty and Staff (http://www.ombuds.wisc.edu/) (for employed graduate students and post-docs, as well as faculty and staff)
- Title IX (https://compliance.wisc.edu/titleix/) (for concerns about discrimination)

BME Grievance Procedures

If a student feels unfairly treated or aggrieved by faculty, staff, or another student, the University offers several avenues to resolve the grievance.

Step 1

The student is encouraged to speak first with the person toward whom the grievance is directed to see if a situation can be resolved at this level. Students are also encouraged to talk with their faculty advisors regarding concerns or difficulties, or reach out to the Graduate Student Services Coordinator or Associate Chair of BME Graduate Advising for additional assistance. These activities do not rise to the level of a formal grievance; however, the student is encouraged to keep documentation of these interactions as they may be useful if a formal grievance is pursued.

Step 2

Should a satisfactory resolution not be achieved, a formal grievance can be filed with the BME Grievance Committee. To do so, the student contacts the Department Administrator, who will provide the student with the name of the current chair of the Grievance Committee. The student will then contact the Chair of the Grievance Committee, who will reply within seven calendar days. If the grievance is with the current Chair of the Grievance Committee, please let the Department Administrator know and they will identify an alternate committee member to contact. It is advised that grievances are filed within 60 calendar days of the alleged unfair treatment to enable a thorough investigation.

Step 3

If the student does not feel comfortable working through the departmental process, they are encouraged to seek out other campus resources including:

- The Assistant Dean for Graduate Affairs in the College of Engineering
- The Graduate School
- UW Division of Diversity, Equity & Educational Achievement (DDEEA)
- McBurney Disability Resource Center
- Employee Assistance Office
- Ombuds Office
- University Health Services

Step 4

At this point, if either party (the student or the person toward whom the grievance is directed) is unsatisfied with the decision of the faculty committee, the party may file a written appeal. Either party has ten working days to file a written appeal to the School/College. For more information, students should consult the College of Engineering Academic Advising Policies and Procedures.

Step 5

Documentation of the grievance will be stored for at least seven years. Significant grievances that set a precedent will be stored indefinitely. The Graduate School has procedures for students wishing to appeal a grievance decision made at the school/college level. These policies are described in the Graduate School's Academic Policies and Procedures.

OTHER

Students are strongly discouraged to pursue positions as Project Assistants, Teaching Assistants or Research Assistants during their time in this program, as the rigor and accelerated nature of this program may not accommodate those work time commitments. Students in this program will not receive the tuition remission that is typically part of the compensation package for a graduate assistantship.

PROFESSIONAL DEVELOPMENT

PROFESSIONAL DEVELOPMENT

GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School's professional development resources (https://grad.wisc.edu/pd/) to build skills, thrive academically, and launch your career.

PROGRAM RESOURCES

The Individual Development Plan (IDP)

An Individual Development Plan (IDP) (https://grad.wisc.edu/pd/idp/) helps graduate students and postdoctoral researchers:

- assess current skills, interests, and strengths;
- make a plan for developing skills to meet academic and professional goals; and
- communicate with supervisors, advisors, and mentors about evolving goals and related skills.

The IDP is a document to be revisited again and again, to update and refine as goals change and/or come into focus, and to record progress and accomplishments.

The university **recommends** IDPs for all postdoctoral researchers and graduate students, and **requires** IDPs for all postdoctoral researchers and graduate students supported by National Institutes of Health (NIH) funding. See the Graduate School for more information and IDP resources (https://grad.wisc.edu/pd/idp/).

Engineering Career Services

The Engineering Career Services (https://ecs.wisc.edu/) staff offers assistance to students searching or preparing for internships, co-ops, and jobs with well-recognized organizations.

The Writing Center

The Writing Center (https://writing.wisc.edu/) is a campus-wide organization that provides free of charge, face-to-face and online consultations for students writing papers, reports, resumes, and applications.

PEOPLE

PEOPLE

FACULTY

Paul Campagnola (Chair)
Randolph Ashton
Randy Bartels
David Beebe
Walter Block
Christopher Brace
Joshua Brockman
Kevin Eliceiri
Shaoqin 'Sarah' Gong
Aviad Hai
Pamela Kreeger
Wan-ju Li
Kip Ludwig
Megan McClean
Beth Meyerand
William Murphy
Krishanu Saha
Melissa Skala
Darryl Thelen
Pallavi Tiwari
Justin Williams
Colleen Witzenburg
Filiz Yesilkoy

INSTRUCTIONAL STAFF AND TEACHING FACULTY

Amit Nimunkar
John Puccinelli
Tracy Jane Puccinelli
Darilis Suarez-Gonzalez
Christa Wille

See also Biomedical Engineering Faculty Directory (http://directory.engr.wisc.edu/bme/).