Biomedical Engineering

Chair: Jianyi Zhang, MD, PhD

Associate Chair of Education: Alan Eberhardt, PhD

Degree Offered	Bachelor of Science in Biomedical Engineering
Accreditation	The Bachelor of Science in Biomedical Engineering degree program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the commission's General Criteria and Program Criteria for Bioengineering and Biomedical and Similarly Named Engineering Programs.
Website	https://www.uab.edu/engineering/bme/undergraduate
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Biomedical engineering (BME) is the application of engineering principles and technology to the solution of problems in the life sciences and medicine. Biomedical engineers create knowledge and develop technologies that improve healthcare delivery and patient outcomes with an emphasis on reducing healthcare costs. Graduates create and apply knowledge at the interface of life sciences and engineering for the benefit of society. The BME undergraduate program prepares graduates to be immediately productive and able to adapt to a rapidly changing environment. In addition to the Blazer Core, the curriculum includes engineering core courses, mathematics, calculus-based physics, biology, chemistry, humanities, social and behavioral sciences, biomedical engineering core courses and electives. The curriculum culminates in a capstone design experience where student teams apply knowledge to solve real-world engineering problems. A bachelor's degree in BME from UAB provides a foundation in biomedical implants and devices, biomaterials, biocomputing, biotransport, and biomedical instrumentation to compete in an increasingly technical medical field, and also prepares students for graduate school, medical school, or professional school.

Vision

To be an internationally recognized, research-oriented Department of Biomedical Engineering: a top choice for undergraduate and graduate education.

Mission

The Department of Biomedical Engineering provides leadership in teaching the principles of engineering and biology and in conducting research that will translate new discoveries in biological engineering science to the fields of public health and clinical medicine. These efforts will enable us to identify new solutions to critical challenges in health care and the life sciences.

Program Educational Objectives

Graduates of the Biomedical Engineering undergraduate program will have:

1. Gained admission to graduate or professional school, or gained employment in engineering and/or health related professions and
2. Pursued opportunities for professional growth, development, and service

Student Outcomes

Upon completion of the BSBME degree program, our graduates will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Academic Warning, Probation, and Readmission

BME students must maintain an institutional (UAB) GPA of at least 2.50. First-term BME freshmen students who have an institutional GPA below 2.50 will be placed on academic warning in BME. If their institutional GPA is not at least 2.50 after the next term enrolled, they will be placed on academic probation in BME. BME undergraduates (other than first-term freshmen) who do not have an institutional GPA of at least 2.50 will be placed on BME academic probation. If at the end of the next term in which they enroll, their institutional GPA is not at least 2.50, they will be reclassified as Undeclared Engineering. To be re-admitted to the BME program, a student must have an institutional GPA of at least 3.00 and make a formal application for readmission.

Program and Graduation Requirements

BME students must have an institutional GPA of at least 2.50 and have completed at least 64 hours of coursework applicable to their degree before they may register for 300-level and 400-level BME courses. BME students must also have an institutional GPA of 2.50 or higher and have earned a grade of C or better in all BME courses to graduate.

Please note the Residency Requirement on the Majors tab.

Please refer to the School of Engineering Overview for School policies related to admission, reasonable progress requirements, and graduation.

Non-Majors Enrolled in BME Coursework

In addition to fulfilling course prerequisites, non-BME students (including students seeking a BME minor) who wish to enroll in 300-level and 400-level BME courses must have an institutional (UAB) GPA of at least 3.00 or permission of the BME Undergraduate Program Director. Non-BME majors may not enroll in BME 423, BME 498, or BME 499.

BME Minors

Please refer to the Minors tab on the School of Engineering's Overview page in this catalog for information specific to BME minors.

Bachelor of Science in Biomedical Engineering

Major in Biomedical Engineering

Requirements		Hours
Blazer Core Requirements		43
CH 115 & 115R & CH 116	General Chemistry I and General Chemistry I Recitation and General Chemistry I Laboratory	
EGR 103	Computer Aided Graphics and Design	
EGR 200	Introduction to Engineering [1]	
EH 101	English Composition I	
EH 102	English Composition II	
MA 125 & 125L	Calculus I and Calculus I Lab	
PH 221 & 221L & 221R	General Physics I and General Physics Laboratory I and General Physics I Recitation	
PH 222 & 222L & 222R	General Physics II and General Physics Laboratory II and General Physics II - Recitation	
Academic Foundations: Reasoning		
Thinking Broadly: History & Meaning		
Thinking Broadly: Creative Arts		
Thinking Broadly: Humans & Their Societies		
City as a Classroom [2]		
Other Required Courses		**70**
BME 310	Biomaterials	
BME 210	Engineering in Biology	
BME 312	Biocomputing	
BME 313	Bioinstrumentation	
BME 333	Biomechanics of Solids	
BME 350	Biological Transport Phenomena	
BME 370	Integrated Physiology	
BME 401	Undergraduate Biomedical Engineering Seminar	
BME 423	Living Systems Analysis and Biostatistics	
BME 498	Capstone Design I Product Development	
BME 499	Capstone Design II	
BY 115 & 115L	Human Anatomy and Human Anatomy Laboratory	
or BY 210 & 210L	Genetics and Genetics Laboratory	
BY 123 & 123L	Introductory Biology I and Introductory Biology I Laboratory	
CE 210	Statics	
CH 117 & 117R & CH 118	General Chemistry II and General Chemistry II Recitation and General Chemistry II Laboratory	
EE 312	Electrical Systems	
EGR 150	Computer Methods in Engineering	
EGR 194	Engineering Explorations	
EGR 265	Math Tools for Engineering Problem Solving [3]	
MA 126	Calculus II	
MA 260	Introduction to Linear Algebra	
ME 215 & 215R	Dynamics and Dynamics Recitation	
MSE 280	Engineering Materials	
Biomedical Engineering Electives		**9**
BME 221	Clinical Innovation I	
BME 289	Undergraduate Research in Biomedical Engineering I [4]	
BME 389	Undergraduate Research in Biomedical Engineering II [4]	
BME 420	Implant-Tissue Interactions	
BME 424	Current Topics in Stem Cell Engineering	
BME 435	Tissue Engineering	
BME 443	Medical Image Processing	
BME 444	Machine Learning for Biomedical Engineering Applications	
BME 450	Computational Neuroscience	
BME 462	Cardiac Electrophysiology	
BME 471	Continuum Mechanics of Solids	
BME 489	Undergraduate Research in Biomedical Engineering III [4]	
BME 490	Special Topics in Biomedical Engineering	
BME 491	Individual Study in Biomedical Engineering [5]	
BME 494	Honors Research I [5, 6]	
Engineering/Math/Science Electives [7]		**6**
Select six credit hours from the following or from the list of Biomedical Engineering electives above		
BY 271 & 271L	Biology of Microorganisms and Biology of Microorganisms Laboratory	
BY 311	Molecular Genetics	
BY 330	Cell Biology	
BY 362	Neurobiology	
CE 337	Hydraulics	
CE 345	Transportation Engineering	
CE 360	Structural Analysis	
CE 395	Engineering Economics	
CE 420	Advanced Mechanics	
CE 433	Solid and Hazardous Wastes Management	
CH 235 & 235R	Organic Chemistry I and Organic Chemistry I Recitation	
CH 237 & 237R	Organic Chemistry II and Organic Chemistry II Recitation	
CH 355	Quantitative Analysis	
CH 460	Fundamentals of Biochemistry	
MA 313	Patterns, Functions and Algebraic Reasoning	
MA 360	Scientific Programming	
MA 361	Mathematical Modeling	
MA 453	Fourier Analysis	
MA 485	Probability	
ME 360	Introduction to Mechatronic Systems Engineering	
ME 370	Kinematics and Dynamics of Machinery	
ME 371	Machine Design	
ME 464	Introduction to Finite Element Method	

MSE 281 & 281L	Physical Materials I and Physical Materials I Laboratory	
MSE 380	Thermodynamics of Materials	
MSE 401	Materials Processing	
MSE 430 & 430L	Polymeric Materials and Polymeric Materials Laboratory	
PH 475	Introduction to Biophysics I	
PH 487	Nanoscale Science and Applications	
RHB 400	Introduction to Rehabilitation Science	
Total Hours		**128**

[1] EGR 200 preferred; other FYE courses accepted

[2]

[3] May substitute MA 227 and MA 252 for EGR 265 and one BME/Engineering/Math/Science Elective

[4] A maximum of 3 hours of combined credit from BME 289, BME 389, and/or BME 489 may be applied to the degree

[5] With approval of the BME Undergraduate Program Director; a maximum of 3 hours of BME 491 or BME 494 may be used for elective credit

[6] Student must be enrolled in BME Honors Program

[7] Other elective courses may be selected with the approval of the BME Undergraduate Program Director

Residency Requirement

In addition to UAB's residency requirement, to earn a bachelor of science in biomedical engineering from UAB, the BME department requires that students complete the following courses at UAB:

Requirements		Hours
BME 423	Living Systems Analysis and Biostatistics	3
BME 498	Capstone Design I Product Development	3
BME 499	Capstone Design II	3
Additional 400-level BME Elective		3
Total Hours		**12**

Concentration in Biomechanics

Students seeking the degree of BSBME may add a concentration in Biomechanics by appropriate selection of their Mathematics/Science/Engineering Electives (3 credit hours), Engineering Elective (3 credit hours), and BME Electives (6 credit hours).

Requirements		Hours
BME 471	Continuum Mechanics of Solids	3
BME 617	Engineering Analysis	3
ME 464	Introduction to Finite Element Method	3
RHB 490	Quantitative Biomechanics of Injury and Rehabilitation	3
Total Hours		**12**

Concentration in Biomaterials/Tissue Engineering

Students seeking the degree of BSBME may add a concentration in Biomaterials/Tissue Engineering by appropriate selections of their Mathematics/Science/Engineering Elective (3 credit hours), Engineering Elective (3 credit hours), and BME Electives (6 credit hours).

Requirements		Hours
Required Courses		
BME 420	Implant-Tissue Interactions	3
BME 435	Tissue Engineering	3
MSE 281	Physical Materials I	4
Elective Courses		**3**
Select one of the following:		
BY 311	Molecular Genetics	
BY 330	Cell Biology	
BY 431	Principles of DNA Technology	
MSE 381	Physical Materials II	
MSE 382	Mechanical Behavior of Materials	
MSE 401	Materials Processing	
MSE 408	Nanobiomaterials	
MSE 413	Composite Materials	
MSE 430	Polymeric Materials	
MSE 464	Metals and Alloys	
MSE 470	Ceramic Materials	
MSE 484	Electronic, Magnetic, and Thermal Prop of Materials	
PH 487	Nanoscale Science and Applications	
Total Hours		**13**

Curriculum for the Bachelor of Science in Biomedical Engineering (BSBME)

Freshman

First Term	Hours	Second Term	Hours
CH 115 & 115R & CH 116^	4	BY 123 & 123L	4
EGR 200[1]	3	CH 117 & 117R & CH 118	4
EH 101[%]	3	EGR 103[#]	3
MA 125 & 125L[*]	4	EGR 194	1
		MA 126	4
	14		**16**

Sophomore

First Term	Hours	Second Term	Hours
BY 210 & 210L	4	BME 210	3
EGR 265[2]	4	CE 210	3
MA 260	3	EE 312	3
PH 221 & 221L & 221R^	4	EGR 150	3
MSE 280	3	PH 222 & 222L & 222R^	4
	18		**16**

Junior

First Term	Hours	Second Term	Hours
BME 310	3	BME 333	3
BME 312	3	BME 350	3
BME 313	3	BME 423	3
BME 370	3	Biomedical Engineering Elective	3
ME 215	3	EH 102[%]	3
		Blazer Core: Creative Arts[5]	3
	15		**18**

Senior			
First Term	**Hours**	**Second Term**	**Hours**
BME 401[3]	1	BME 499	3
BME 498	3	Biomedical Engineering Elective	3
BME Elective	3	Blazer Core: History & Meaning[5]	3
MA / SCI / EGR / BME Elective[2,4]	3	Blazer Core: City as a Classroom[$]	3
MA / SCI / EGR / BME Elective[4]	3	Blazer Core: Reasoning[5]	3
Blazer Core: Humans & Their Societies[5]	3		
	16		**15**

Total credit hours: 128

1 EGR 200 preferred; other FYE courses accepted
2 May substitute MA 227 and MA 252 for EGR 265 and one BME/Engineering/Math/Science Elective
3 Seminar may be taken during any semester
4 Students using this curriculum as a pre-health professional program (pre-med, pre-dental, or pre-optometry) may use CH 235 or CH 237 or CH 460 for this elective
5 Please refer to the Blazer Core as specified for engineering majors
^ Satisfies Blazer Core: Scientific Inquiry
% Satisfies Blazer Core: Writing
# Satisfies Blazer Core: Communicating in the Modern World
* Satisfies Blazer Core: Quantitative Literacy
$ CE 280 preferred; other CAC courses accepted

Courses

BME 011. Undergraduate Internship in BME. 0 Hours.
Engineering internship experience in preparation for the student's intended career. Students in a university recognized cooperative education experience should register for COP 011 or COP 012.

BME 210. Engineering in Biology. 3 Hours.
Application of engineering to the study of biology on the cellular and molecular level. Engineering solutions in genomics, proteomics, and nanotechnology to investigate cellular and molecular process.
Prerequisites: BY 123 [Min Grade: C]

BME 221. Clinical Innovation I. 3 Hours.
The goals of this class are to develop an understanding of the concept of clinical innovation and develop skills in written and oral communication of innovation in the context of a business proposal/presentation.

BME 289. Undergraduate Research in Biomedical Engineering I. 1 Hour.
Undergraduate research experiences in biomedical engineering. Must have sophomore standing.
Prerequisites: EGR 194 [Min Grade: C] or EGR 200 [Min Grade: C] or EGR 111 [Min Grade: C] or HC 111 [Min Grade: C] and (MA 125 [Min Grade: C] or MA 225 [Min Grade: C])

BME 310. Biomaterials. 3 Hours.
Introduction to wide range of materials used for biomedical applications. Physical, chemical and mechanical properties of biomaterials.
Prerequisites: MSE 280 [Min Grade: C] and BME 210 [Min Grade: C]

BME 311. Biomaterials for Non-Majors. 3 Hours.
Wide range of materials used for biomedical applications. Physical, chemical and mechanical properties of biomaterials.
Prerequisites: MSE 280 [Min Grade: C]

BME 312. Biocomputing. 3 Hours.
Introduction to computational techniques used in biomedical engineering.
Prerequisites: EGR 150 [Min Grade: C] and EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and MA 260 [Min Grade: C](Can be taken Concurrently)

BME 313. Bioinstrumentation. 3 Hours.
An introduction to instrumentation used to make biological and physiological measurements. Techniques include acquisition and analysis of bioelectric signals and instrument control.
Prerequisites: EE 312 [Min Grade: C] and (MA 227 [Min Grade: C] and MA 252 [Min Grade: C] or EGR 265 [Min Grade: C])

BME 333. Biomechanics of Solids. 3 Hours.
Application of mechanics of solids principles to biomedical engineering problems; stress-strain of bone, viscoelasticity and constitutive equations of tissues, mechanics of the cell, introduction to molecular mechanics.
Prerequisites: CE 210 [Min Grade: C] or EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and ME 215 [Min Grade: C](Can be taken Concurrently)

BME 350. Biological Transport Phenomena. 3 Hours.
Basic mechanisms and mathematical analysis of transport processes with biological and biomedical applications. Analysis of flow, transport and reaction processes for biological fluids and biological molecules with applications towards development of artificial organs, drug delivery systems and tissue engineering products.
Prerequisites: CE 210 [Min Grade: C] and EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and BME 210 [Min Grade: C] and BME 370 [Min Grade: C](Can be taken Concurrently) or BY 409 [Min Grade: C](Can be taken Concurrently) and ME 215 [Min Grade: C](Can be taken Concurrently)

BME 370. Integrated Physiology. 3 Hours.
Integrated Physiology will introduce undergraduate students to mathematical models of major physiological systems. Basic anatomy will be reviewed in pre-recorded videos to be watched prior to coming to synchronous lectures. Lectures will include discussions, derivations of relevant equations, and development of models to demonstrate understanding of biological systems. In-class activities will be used as means to provide interactive content that will be assessed via Assignments and Exams. The course will culminate in a final project where teams of students select a pathological condition and model it in Matlab, including comparing to normal conditions and with currently-available clinical interventions. Open to junior and senior level Biomedical Engineering students.
Prerequisites: EGR 150 [Min Grade: C] and BME 210 [Min Grade: C]

BME 389. Undergraduate Research in Biomedical Engineering II. 1-2 Hour.
Undergraduate research experiences in biomedical engineering.

BME 401. Undergraduate Biomedical Engineering Seminar. 1 Hour.
Undergraduate seminar.

BME 420. Implant-Tissue Interactions. 3 Hours.
An overview of implant biocompatibility including tissue histology, histopathology of implant response and the regulatory process for medical devices. Emphasis placed on ethical issues related to design, development, and implementation of biomedical implants. Ethics and Civic Responsibility are significant components of this course.
Prerequisites: BME 310 [Min Grade: C] or BME 311 [Min Grade: C]

BME 423. Living Systems Analysis and Biostatistics. 3 Hours.
Basic concepts and techniques of measurement processing and analysis of data from living systems. Statistics, analysis of variance and regression analysis. Emphasis is placed on data analysis and presentation of group projects.
Prerequisites: BME 312 [Min Grade: C]

BME 424. Current Topics in Stem Cell Engineering. 3 Hours.
This course is designed for students interested in the field of stem cells, regenerative medicine, and tissue engineering using stem cells and stem cell derived cells. The course will introduce the role of stem cells in tissue growth and development, the theory behind the design and in vitro construction of tissue and organ replacements, and the applications of biomedical engineering principles to the treatment of tissue-specific diseases. Students will have hands on experience on culturing and analyzing stem cells, stem cell differentiation, analysis of functional and physiological properties of differentiated cells, and fabricating basic engineered-tissues.
Prerequisites: BY 123 [Min Grade: C] and (BY 210 [Min Grade: C] or BY 212 [Min Grade: C] or BY 115 [Min Grade: C])

BME 435. Tissue Engineering. 3 Hours.
Principles underlying strategies for regenerative medicine such as stem-cell based therapy, scaffold design, proteins or genes delivery, roles of extracellular matrix, cell-materials interactions, angiogenesis, tissue transplantation, mechanical stimulus and nanotechnology.
Prerequisites: BME 310 [Min Grade: C] or BME 311 [Min Grade: C]

BME 443. Medical Image Processing. 3 Hours.
Fundamental topics of medical image processing to practical applications using conventional computer software.
Prerequisites: BME 312 [Min Grade: C](Can be taken Concurrently) and PH 222 [Min Grade: C]

BME 444. Machine Learning for Biomedical Engineering Applications. 3 Hours.
This course provides the introduction to the practical aspects of machine learning such that the students can apply some basic machine learning techniques in simple biomedical engineering problems. The course also provides the principle of machine learning ‘thinking process’ for the next machine learning – AI courses and more in-depth machine learning studies. By ‘thinking process’, at the beginning, it is better to view machine learning like human learning. Students who have experience with Data Mining may further understand the fundamental differences between Machine Learning and Data Mining, although these two fields share many concepts and techniques. Also, the student will learn fundamental theories in machine learning to be able to develop new machine learning techniques and research machine learning in biomedical engineering.
Prerequisites: EGR 150 [Min Grade: C]

BME 450. Computational Neuroscience. 3 Hours.
This course examines the computational principles used by the nervous system. Topics include: biophysics of axon and synapse, sensory coding (with an emphasis on vision and audition), planning and decision-making, and synthesis of motor responses. There will be an emphasis on systems approach throughout. Homework includes simulations.
Prerequisites: BME 312 [Min Grade: C]

BME 455. NextGen-BioMed Bootcamp. 3 Hours.
The course will provide students with a solid foundation in the principles, methods, and techniques used in biomedical research. The course will cover a range of topics, including experimental design, cell and molecular biology techniques, immunological techniques, animal models and in vivo studies, and laboratory safety and good laboratory practices.
Prerequisites: BME 210 [Min Grade: C] or BY 210 [Min Grade: C] or BY 330 [Min Grade: C]

BME 461. Bioelectric Phenomena. 3 Hours.
Quantitative methods in electrophysiology with focus on using simulations to examine responses in electrically excitable cell types.
Prerequisites: BME 312 [Min Grade: C]

BME 462. Cardiac Electrophysiology. 3 Hours.
Experimental and computational method on cardiac electrophysiology, ionic current, action potentials, electrical propagation, the electrocardiogram, electromechanical coupling, cardiac arrhythmias, effects of electric fields in cardiac tissue, defibrillation and ablation.
Prerequisites: BME 312 [Min Grade: C]

BME 465. Mechanobiology. 3 Hours.
The overall course objective is to develop understanding of mechanobiological processes in cells as they relate to both development and disease pathways. The course will focus on cancer and vascular biology, however there is significant overlap of these pathways with developmental signaling pathways. Students will learn not only molecular biology techniques for characterizing mechanobiology and cell phenotype but also be able to describe biomechanical analysis protocols including micropipette aspiration, atomic force microscopy, traction force microscopy, and optical/magnetic tweezers. The course will include comprehensive literature reviews relevant to the subject area. Students will present formal presentations on articles discussing mechanobiology topics; students will prepare a written report in the style of a commentary article on a published journal article discussing a relevant mechanobiological project.

BME 471. Continuum Mechanics of Solids. 3 Hours.
Matrix and tensor mathematics, fundamentals of stress, momentum principles, Cauchy and Piola-Kirchoff stress tensors, static equilibrium, invariance, measures of strain, Lagrangian and Eulerian formulations, Green and Almansi strain, deformation gradient tensor, infinitesimal strain, constitutive equations, finite strain elasticity, strain energy methods, 2-D Elasticity, Airy Method, viscoelasticity, mechanical behavior of polymers.
Prerequisites: EGR 265 [Min Grade: C] or (MA 227 [Min Grade: C] and MA 252 [Min Grade: C]) and (BME 333 [Min Grade: C] or CE 220 [Min Grade: C])

BME 472. Industrial Bioprocessing and Biomanufacturing. 3 Hours.
This course will introduce students to the growing industries related to biomedical, biopharmaceutical and biotechnology. It is targeted to offer the students marketable skills to work in a vital area of economic growth and also convey some of the challenges and opportunities awaiting.
Prerequisites: BME 310 [Min Grade: C](Can be taken Concurrently)

BME 489. Undergraduate Research in Biomedical Engineering III. 1-2 Hour.
Undergraduate research experiences in biomedical engineering. Must have senior standing.

BME 490. Special Topics in Biomedical Engineering. 1-3 Hour.
Special Topic in Biomedical Engineering.

BME 491. Individual Study in Biomedical Engineering. 1-6 Hour.
Individual Study in Biomedical Engineering.

BME 494. Honors Research I. 1-3 Hour.
Research experiences for undergraduates enrolled in the departmental honors program. The student should write a proposal and make a presentation based on the proposal.
Prerequisites: EGR 301 [Min Grade: C] or STH 201 [Min Grade: C]

BME 495. Honors Research II. 1-3 Hour.
Research opportunities for undergraduate students in the Biomedical Engineering Honors Program. Research areas include cardiac electrophysiology, brain imaging, biomedical implants, and tissue engineering.
Prerequisites: BME 494 [Min Grade: C]

BME 496. Biomedical Engineering Honors Seminar. 1 Hour.
Must be enrolled in an Honors Program.
Prerequisites: BY 123 [Min Grade: B] and BY 286 [Min Grade: B]

BME 498. Capstone Design I Product Development. 3 Hours.
Design and development of medical-products. Through experiential learning, students go through the early phases of engineering design innovation for medical products, starting with clinical immersion to determine a critical health-care need. Engineering students work in multi-disciplinary teams that include students from the School of Business to develop design concepts for both a client-based prototype and a commercializable version. Designs take into account client needs as well as legal, regulatory, and marketing requirements. Business ethics are also covered. Emphasis is placed on communication in both oral and written format to targeted audiences.
Prerequisites: (BME 310 [Min Grade: C] and BME 312 [Min Grade: C]) or (BME 310 [Min Grade: C] and BME 313 [Min Grade: C]) or (BME 310 [Min Grade: C] and BME 333 [Min Grade: C]) or (BME 310 [Min Grade: C] and BME 350 [Min Grade: C]) or (BME 312 [Min Grade: C] and BME 313 [Min Grade: C]) or (BME 312 [Min Grade: C] and BME 333 [Min Grade: C]) or (BME 312 [Min Grade: C] and BME 350 [Min Grade: C]) or (BME 313 [Min Grade: C] and BME 333 [Min Grade: C]) or (BME 313 [Min Grade: C] and BME 350 [Min Grade: C]) or (BME 333 [Min Grade: C] and BME 350 [Min Grade: C]) or BME 370 [Min Grade: C]

BME 499. Capstone Design II. 3 Hours.
Capstone design project; a continuation of BME 498. Through experiential learning, student teams complete the engineering design process for their client-based prototype incorporating engineering standards and realistic constraints. Student teams develop a business plan to present to potential business partners and product development teams from established companies. Additional skills learned in this part of the design process include: development of business proposals, project planning and scheduling, project execution and resource scheduling, communication of design, and interim and final design reviews. Emphasis is placed on communication of design and design justification in both an oral and written format to targeted audiences.
Prerequisites: BME 498 [Min Grade: C] and BME 310 [Min Grade: C] and BME 312 [Min Grade: C] and BME 313 [Min Grade: C] and BME 333 [Min Grade: C](Can be taken Concurrently) and BME 350 [Min Grade: C] (Can be taken Concurrently) and BME 423 [Min Grade: C](Can be taken Concurrently)