BIOMEDICAL ENGINEERING, BACHELOR OF SCIENCE

Students seeking a B.S. degree focus their engineering electives on one of seven subspecialties that incorporates traditional engineering disciplines and biomedical applications. See the Biomedical Engineering Undergraduate website (https://www.bme.jhu.edu/undergraduate/) for additional information.

Highly motivated biomedical engineering students may also pursue the 3+1 BS/MSE degree program. Students will complete both degrees by the end of their fourth year, with the opportunity to pursue an additional research thesis during an optional fifth year. The accelerated timeline is designed to maximize students' training potential, making our graduates more competitive for careers in industry and medicine, as well as Ph.D. and medical school programs. Students interested in the 3+1 program apply the summer after their junior year. For more information, visit the Biomedical Engineering Undergraduate website (https:// www.bme.jhu.edu/academics/undergraduate/31-bs-mse-program/).

Program Requirements

(See also General Requirements for Departmental Majors (https://ecatalogue.jhu.edu/ksas-wse/undergraduate-policies/academic-policies/ requirements-bachelors-degree/).)

The B.S. degree in biomedical engineering requires 129 credits. The courses listed below must either be taken or passed by examination for advanced credit. All courses used to satisfy degree requirements must be taken for a grade (no S/U grading may be counted). No more than 6 credits of engineering, science, or mathematics courses in which a grade of D was received may be counted.

Code Basic Sciences ¹	Title Cre	edits
AS.171.101	General Physics: Physical Science Major I	4
or AS.171.107	General Physics for Physical Sciences Majors (AL)	
AS.171.102	General Physics: Physical Science Major II	4
or AS.171.108	General Physics for Physical Science Majors (AL)	
AS.173.111	General Physics Laboratory I	1
AS.173.112	General Physics Laboratory II	1
AS.030.101	Introductory Chemistry I	3
AS.030.102	Introductory Chemistry II	3
AS.030.105	Introductory Chemistry Laboratory I	1
AS.030.106	Introductory Chemistry Laboratory II	1
Mathematics ²		
AS.110.108	Calculus I (Physical Sciences & Engineering)	4
AS.110.109	Calculus II (For Physical Sciences and Engineering)	4
AS.110.202	Calculus III	4
or AS.110.211	Honors Multivariable Calculus	
EN.553.291	Linear Algebra and Differential Equations	4
Select one of the	following:	3-4
EN.553.311	Intermediate Probability and Statistics	
EN.553.413	Applied Statistics and Data Analysis	
EN.553.430	Mathematical Statistics	
EN.553.433	Monte Carlo Methods	

Humanities and Social Sciences

Select six 3-credit courses. At least one course must be at the 300-18 level or higher.³

Biomedica	Core		
EN.580.11	I	Biomedical Engineering and Design	2
EN.580.15	1	Structural Biology of Cells	3
EN.580.153	3	Structural Biology of Cells Laboratory	1
EN.580.22	I	Biochemistry and Molecular Engineering	4
EN.580.24	I	Statistical Physics	2
EN.580.242	2	Biological Models and Simulations	2
EN.580.243	3	Linear Signals and Systems	2
EN.580.244	1	Nonlinear Dynamics of Biological Systems	2
EN.580.246	õ	Systems and Controls	2
EN.580.248	3	Systems Biology of the Cell	2
EN.580.475	5	Biomedical Data Science	2
EN.580.477	7	Biomedical Data Science Laboratory	1
EN.580.48	5	Computational Medicine: Cardiology	2
EN.580.487		Computational Medicine: Cardiology Laboratory	1
		following core electives: ⁴	6
EN.580.4	424	Neuroengineering and Lab	
EN.580.4	427	Microphysiological Systems and Laboratory	
EN.580.4	452	Cell and Tissue Engineering Lab	
EN.580.4	453	Immunoengineering Principles and Applications with Laboratory	
EN.580.4	454	Methods in Nucleic Acid Sequencing Lab	
EN.580.4		Build an Imager	
Career Exp	loratior	n in BME ⁵	
Focus Area	1		
1 0000 / 11 00			
Select one		following:	21
Select one Biomedi	of the t cal Dat	a Science (p. 3)	21
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Select one Biomedi Comput Genomi	of the f cal Dat ational cs and	ra Science (p. 3) Medicine (p. 4) Systems Biology (p. 4)	21
Select one Biomedi Comput Genomic Imaging	of the f cal Dat ational cs and and M	ra Science (p. 3) Medicine (p. 4) Systems Biology (p. 4) edical Devices (p. 5)	21
Select one Biomedi Comput Genomic Imaging Immuno	of the f cal Dat ational cs and and M engine	a Science (p. 3) Medicine (p. 4) Systems Biology (p. 4) edical Devices (p. 5) ering (p. 6)	21
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EN.580.456 & EN.580.457	Introduction to Rehabilitation Engineering and Introduction to Rehabilitation Engineering: Design Lab
or EN.585.7	Rehabilitation Engineering II
EN.580.471 & EN.580.571	Principles of Design of BME Instrumentation and Honors Instrumentation ⁹
EN.580.480 & EN.580.481	Precision Care Medicine I and Precision Care Medicine II
EN.601.455 & EN.601.456 or EN.601.4	Computer Integrated Surgery I and Computer Integrated Surgery II Computer Integrated Surgery II - Teams
EN.660.345 & EN.660.346	Multidisciplinary Engineering Design 1 and Multidisciplinary Engineering Design 2
Computer Program	mming
EN.500.112	Gateway Computing: JAVA
or EN.500.113	Gateway Computing: Python
or EN.500.114	Gateway Computing: Matlab

Free Electives

Select 9 credits from any area. This can include Intersession S/U courses as well as other courses taken for S/U or grade and not used to fulfill another requirement.

- ¹ Students who receive credit for AP Physics I and/or Physics II will receive a waiver for the laboratory course. This will reduce the required number of credits for Basic Sciences by 1 or 2 credits. Students are still required to complete at least 129 total credits for the degree.
- ² Students who take an approved math course and receive 3 credits will have a total of 19 credits. Students are still required to complete at least 129 total credits for the degree.
- ³ One course in which ethical and social issues related to technology or medicine is recommended, and at least two semesters of writing-intensive courses, see Writing Requirement (https://ecatalogue.jhu.edu/engineering/full-time-residential-programs/ undergraduate-policies/academic-policies/requirements-bachelorsdegree/#writingtext).
- ⁴ These courses cannot be double-counted toward the 21-credit focus area requirement. Courses taken in excess of the 6 credit core elective requirement can be counted in a relevant focus area.
- ⁵ Career Exploration in BME is a 0-credit self-identified set of careerrelated events (lectures, panels, journal clubs, etc.) beginning in the spring semester of year one and continuing until graduation. Career Exploration is administered through a learning management site; students will be enrolled by the department.
- ⁶ Each 2-semester sequence must be taken in its entirety.
- ⁷ Juniors taking ECE Ideation and Design Lab must take EN.520.363 ECE Ideation and Design Lab in the fall/spring or EN.520.363 ECE Ideation and Design Lab in the spring/fall for a total of 2 semesters to satisfy the BME design requirement. Students interested in longitudinal involvement may take the course up to 5 times.
- ⁸ Seniors taking ECE Ideation and Design Lab must take EN.520.463 ECE Ideation and Design Lab in the fall/spring or EN.520.463 ECE Ideation and Design Lab in the spring/fall for a total of 2 semesters to satisfy the BME design requirement. Students interested in longitudinal involvement may take the course up to 5 times.
- ⁹ EN.580.571 (2 credits) is offered during the spring semester. Instructor permission is required.

Focus Areas

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Building on the foundation of the core curriculum, each student is required to take a cohesive sequence of advanced engineering encompassing one of seven Biomedical Engineering focus areas. A student's choice of focus area is made during the sophomore year and is based on their experience with the Biomedical Engineering Core and how they wish to apply their skill, knowledge, and passion:

Biomedical Data Science—involves the analysis of large-scale biomedical datasets to understand how living systems function. Our academic and research programs in Biomedical Data Science center on developing new data analysis technologies in order to understand disease mechanisms and provide improved health care at lower costs. Our curriculum in Biomedical Data Science trains students to extract knowledge from biomedical datasets of all sizes in order to understand and solve health-related problems. Students collaborate with faculty throughout the schools of Medicine and Engineering to develop novel cloud-based technologies and data analysis methods that will improve our ability to diagnose and treat diseases.

Computational Medicine—aims to advance health care by developing computational models of disease, personalizing these models using data from patients, and applying these models to improve the diagnosis and treatment of disease. We are using these patient models to discover novel risk biomarkers, predict disease progression, design optimal treatments, and identify new drug targets for applications such as cancer, cardiovascular disease, and neurological disorders. Our curriculum in Computational Medicine bridges biology with mathematics, engineering, and computational science. Students develop new solutions in personalized medicine by building computational models of the molecular biology, physiology, and anatomy of human health and disease.

Genomics and Systems Biology—connects the information in our genome and epigenome to the function of biological systems, from cells to tissues and organs. We are developing new computational and experimental methods for systematic analysis of genomes, building models that span length and time scales, and using synthetic biology to design new biomedical systems for human health applications. Our curriculum spans the fields of engineering, computer science, biology, and biostatistics. Students develop tools to understand the genetic, molecular, and cellular behaviors that cause disease.

Imaging and Medical Devices—involves the measurement of spatiotemporal distributions over scales ranging from molecules and cells to organs and whole populations. Grounded in mathematics, physics, and biological systems, our academic and research programs in Imaging & Medical Devices center on data-intensive image analysis and new imaging technologies that include optics, ultrasound, X-ray/CT, MRI, and molecular imaging. Our curriculum in Imaging & Medical Devices spans fundamental development of imaging technologies, incorporation of these technologies into instruments, and translation into the clinic. In addition to collecting anatomical data, students learn to use data analysis and computer simulations to generate functional images that allow physicians to understand organs and tissues from the smallest scale to the systems level.

Immunoengineering—harnesses the power of the immune system to treat diseases such as cancer and promote tissue regeneration and healing. Our curriculum trains students in immunoengineering at the molecular, cellular, and systems levels. Particular emphasis is placed on novel materials and methods to harness the body's immune system to fight disease, and to promote tissue repair and healing. Students develop new biomaterials, vaccines, therapeutics, and systems to understand immune cell function and guide immune cell behavior.

Neuroengineering—comprises fundamental, experimental, computational, theoretical, and quantitative research aimed at understanding and augmenting brain function in health and disease across multiple spatiotemporal scales. Our curriculum in Neuroengineering trains students to develop and apply new technologies to understand and treat neurological disorders. Students build tools to define, control, enhance, or inhibit neural networks in precise spatial and temporal domains.

Translational Cell and Tissue Engineering—develops and translates advanced technologies to enhance or restore function at the molecular, cellular, and tissue levels. Hopkins BME is leading an effort in translational cell and tissue engineering that bridges discovery, innovation, and translation through basic science, engineering, and clinical endeavors. Our curriculum spans a variety of novel methods that harness the power of cells, materials, and advanced therapeutics to promote tissue repair and to treat disease. Students develop new techniques and biomaterials to guide cell behavior and reconstruct damaged tissues and organs.

Courses in a focus area must be taken for a total of 21 or more credits. At least 15 credits must come from the relevant upper-level engineering course list; a maximum of six credits from the non-upper-level engineering course lists may be used. Please refer to www.bme.jhu.edu/ undergraduate/resources.htm (https://www.bme.jhu.edu/academics/ undergraduate/undergraduate-focus-areas-courses/) for applicable courses designed for each focus area by faculty members with research interests appropriate to the area; all faculty members are active participants in shaping the undergraduate curriculum.

Biomedical Data Science Focus Area

Code	Title	Credits
Upper-Level Engi	ineering Courses	
EN.520.344	Introduction to Digital Signal Processing	3
EN.520.385	Signals, Systems, & Learning	3
EN.520.412	Machine Learning for Signal Processing	3
EN.520.414	Image Processing & Analysis	3
EN.520.415	Image Process & Analysis II	3
EN.520.432	Medical Imaging Systems	3
EN.520.447	Information Theory	3
EN.530.410	Biomechanics of the Cell	3
EN.540.409	Dynamic Modeling and Control	4
EN.540.414	Computational Protein Structure Prediction and Design	3
EN.540.421	Project in Design: Pharmacodynamics	3
EN.540.432	Project in Design: Pharmacokinetics	3
EN.520.440	Machine Intelligence on Embedded Systems	3
EN.540.468	Introduction to Nonlinear Dynamics and Chaos	3
EN.553.361	Introduction to Optimization	4
EN.553.362	Introduction to Optimization II	4
EN.553.371	Cryptology and Coding	4
EN.553.385	Introduction to Computational Mathematics	4
EN.553.386	Scientific Computing: Differential Equations	4
EN.553.391	Dynamical Systems	4
EN.553.400	Mathematical Modeling and Consulting	4
EN.553.401	Introduction to Research	3

EN.553.413	Applied Statistics and Data Analysis	4
EN.553.420	Probability	4
or EN.553.421	Honors Introduction to Probability	
EN.553.426	Introduction to Stochastic Processes	4
EN.553.430	Mathematical Statistics	4
EN.553.433	Monte Carlo Methods	4
EN.553.436	Introduction to Data Science	4
EN.553.450	Computational Molecular Medicine	4
EN.553.463	Network Models in Operations Research	4
EN.553.467	Deep Learning in Discrete Optimization	3
EN.553.472	Graph Theory	4
EN.553.488	Computing for Applied Mathematics	3
EN.553.492	Mathematical Biology	3
EN.553.493	Mathematical Image Analysis	4
EN.553.630	Mathematical Statistics	4
EN.553.720	Probability Theory I	4
EN.553.721	Probability Theory II	3
EN.553.730	Statistical Theory	4
EN.553.731	Statistical Theory II	3
EN.553.764	Modeling, Simulation, and Monte Carlo	3
EN.580.431	Introduction to Computational Medicine: Imaging	2
EN.580.433	Introduction to Computational Medicine: The Physiome	2
EN.580.437	Biomedical Data Design	4
EN.580.438	Biomedical Data Design II	4
EN.580.439	Models of the Neuron	4
EN.580.447	Computational Stem Cell Biology	3
EN.580.458	Computing the Transcriptome	3
EN.580.460	Epigenetics at the Crossroads of Genes and the Environment	1.5
EN.580.462	Representations of Choice	3
EN.580.464	Advanced Data Science for Biomedical Engineering	4
EN.580.480	Precision Care Medicine I	4
EN.580.481	Precision Care Medicine II	4
EN.580.488	Foundations of Computational Biology and Bioinformatics	3
EN.580.491	Learning, Estimation and Control	3
EN.580.709	Sparse Representations in Computer Vision and Machine Learning	3
EN.601.315	Databases	3
EN.601.318	Operating Systems	3
EN.601.320	Parallel Programming	3
EN.601.350	Genomic Data Science	3
EN.601.402	Digital Health and Biomedical Informatics	1
EN.601.415	Databases	3
EN.601.433	Intro Algorithms	3
EN.601.434	Randomized and Big Data Algorithms	3
EN.601.443	Security & Privacy in Computing	3
EN.601.446	Sketching and Indexing for Sequences	3
EN.601.447	Computational Genomics: Sequences	3
EN.601.454	Introduction to Augmented Reality	3
EN.601.455	Computer Integrated Surgery I	4

EN.601.456Computer Integrated Surgery II3EN.601.457Computer Graphics3EN.601.461Computer Vision3EN.601.463Algorithms for Sensor-Based Robotics3EN.601.464Artificial Intelligence3EN.601.465Natural Language Processing4EN.601.466Information Retrieval and Web Agents3EN.601.475Machine Learning Theory3EN.601.476Machine Learning: Data to Models3EN.601.477Causal Inference3EN.601.476Machine Learning: Deep Learning4EN.601.482Machine Learning: Deep Learning4EN.601.491Human-Robot Interaction3Contact the department advising office for course additions.3 200-Level Engineering Courses 3A maximum of 3 credits from this list may count in focus area3EN.580.212Design Team Health-Tech Project II3EN.601.226Data Structures4EN.601.229Computer System Fundamentals3A maximum of 3 credits from this list may count in focus area4AS.110.311Methods of Complex Analysis4AS.110.405Real Analysis I4AS.110.413Fourier Analysis4AS.110.421Dynamical Systems4AS.110.443Fourier Analysis4EN.580.112Design Team Health-Tech Project II3EN.580.211Design Team Health-Tech Project II3EN.580.211Design Team Health-Tech Proje			
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200-Level Engineering CoursesA maximum of 3 credits from this list may count in focus areaEN.580.212Design Team Health-Tech Project IIS80.298Advanded Design TeamEN.601.226Data StructuresComputer System Fundamentals3Non Upper-Level Engineering CoursesA maximum of 3 credits from this list may count in focus areaAS.110.311Methods of Complex AnalysisAS.110.405Real Analysis IAS.110.421Dynamical SystemsAS.110.423Fourier AnalysisEN.580.112Design Team Health-Tech Project IISEN.580.211Design Team Health-Tech Project ISEN.601.231Automata & Computation TheoryStudents may use a maximum of 3 research credits (courses coded	EN.601.491	Human-Robot Interaction	3
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EN.601.229Computer System Fundamentals3Non Upper-Level Engineering Courses3A maximum of 3 credits from this list may count in focus areaAS.110.311Methods of Complex Analysis4AS.110.405Real Analysis I4AS.110.421Dynamical Systems4AS.110.443Fourier Analysis4EN.580.112Design Team Health-Tech Project II3EN.580.211Design Team Health-Tech Project I3EN.601.231Automata & Computation Theory3Students may use a maximum of 3 research credits (courses coded3	EN.580.298	Advanded Design Team	3
Non Upper-Level Engineering CoursesA maximum of 3 credits from this list may count in focus areaAS.110.311Methods of Complex AnalysisAS.110.405Real Analysis IAS.110.421Dynamical SystemsAS.110.443Fourier AnalysisFN.580.112Design Team Health-Tech Project IIBN.580.211Design Team Health-Tech Project IStudents may use a maximum of 3 research credits (courses coded	EN.601.226	Data Structures	4
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AS.110.311Methods of Complex Analysis4AS.110.405Real Analysis I4AS.110.421Dynamical Systems4AS.110.443Fourier Analysis4EN.580.112Design Team Health-Tech Project II3EN.580.211Design Team Health-Tech Project I3EN.601.231Automata & Computation Theory3Students may use a maximum of 3 research credits (courses coded	Non Upper-Lev	el Engineering Courses	
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AS.110.421Dynamical Systems4AS.110.443Fourier Analysis4EN.580.112Design Team Health-Tech Project II3EN.580.211Design Team Health-Tech Project I3EN.601.231Automata & Computation Theory3Students may use a maximum of 3 research credits (courses coded	AS.110.311	Methods of Complex Analysis	4
AS.110.443Fourier Analysis4EN.580.112Design Team Health-Tech Project II3EN.580.211Design Team Health-Tech Project I3EN.601.231Automata & Computation Theory3Students may use a maximum of 3 research credits (courses coded	AS.110.405	Real Analysis I	4
EN.580.112Design Team Health-Tech Project II3EN.580.211Design Team Health-Tech Project I3EN.601.231Automata & Computation Theory3Students may use a maximum of 3 research credits (courses coded	AS.110.421	Dynamical Systems	4
EN.580.211Design Team Health-Tech Project I3EN.601.231Automata & Computation Theory3Students may use a maximum of 3 research credits (courses coded	AS.110.443	Fourier Analysis	4
EN.601.231Automata & Computation Theory3Students may use a maximum of 3 research credits (courses coded	EN.580.112	Design Team Health-Tech Project II	3
Students may use a maximum of 3 research credits (courses coded	EN.580.211	Design Team Health-Tech Project I	3
	EN.601.231	Automata & Computation Theory	3
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Computational Medicine Focus Area

Code	Title	Credits
Upper-Level Engi	neering Courses	
EN.520.315	Intro. to Bio-Inspired Processing of Audio-Visua Signals	al 3
EN.520.385	Signals, Systems, & Learning	3
EN.520.432	Medical Imaging Systems	3
EN.530.343	Design and Analysis of Dynamical Systems	3
EN.530.410	Biomechanics of the Cell	3
EN.530.676	Locomotion Dynamics & Control	3
EN.540.421	Project in Design: Pharmacodynamics	3
EN.540.432	Project in Design: Pharmacokinetics	3
EN.553.361	Introduction to Optimization	4
EN.553.386	Scientific Computing: Differential Equations	4
EN.553.391	Dynamical Systems	4
EN.553.420	Probability	4
or EN.553.421	Honors Introduction to Probability	
EN.553.426	Introduction to Stochastic Processes	4
EN.553.430	Mathematical Statistics	4
EN.553.436	Introduction to Data Science	4
EN.553.450	Computational Molecular Medicine	4

EN.580.430	Systems Pharmacology and Personalized Medicine	4
EN.580.431	Introduction to Computational Medicine: Imaging	2
EN.580.433	Introduction to Computational Medicine: The Physiome	2
EN.580.437	Biomedical Data Design	4
EN.580.438	Biomedical Data Design II	4
EN.580.439	Models of the Neuron	4
EN.580.447	Computational Stem Cell Biology	3
EN.580.460	Epigenetics at the Crossroads of Genes and the Environment	1.5
EN.580.462	Representations of Choice	3
EN.580.480	Precision Care Medicine I	4
EN.580.481	Precision Care Medicine II	4
EN.580.488	Foundations of Computational Biology and Bioinformatics	3
EN.580.491	Learning, Estimation and Control	3
EN.580.688	Foundations of Computational Biology and Bioinformatics	3
EN.601.350	Genomic Data Science	3
EN.601.447	Computational Genomics: Sequences	3
EN.601.455	Computer Integrated Surgery I	4
EN.601.456	Computer Integrated Surgery II	3
EN.601.461	Computer Vision	3
EN.601.475	Machine Learning	3
EN.601.476	Machine Learning: Data to Models	3
EN.601.482	Machine Learning: Deep Learning	4
EN.601.496	Computer Integrated Surgery II - Teams	3
Contact the depar	tment advising office for course additions.	
200-Level Enginee	ering Courses	
A maximum of 3 c	redits from this list may count in focus area	
EN.580.212	Design Team Health-Tech Project II	3
EN.580.298	Advanded Design Team	3
EN.601.226	Data Structures	4
EN.601.229	Computer System Fundamentals	3
EN.601.231	Automata & Computation Theory	3
Non Upper-Level I	Engineering Courses	
A maximum of 3 c	redits from this list may count in focus area	
EN.580.112	Design Team Health-Tech Project II	3
EN.580.211	Design Team Health-Tech Project I	3
	a maximum of 3 research credits (courses coded non-upper-level engineering course.	

Genomics and Systems Biology Focus Area

Code	Title	Credits		
Upper-Level Engineering Courses				
EN.510.311	Structure Of Materials	3		
EN.510.316	Foundations of Biomaterials	3		
EN.510.407	Biomaterials Principles and Applications	3		
EN.510.436	Biomaterials for Cell Engineering	3		
EN.520.315	Intro. to Bio-Inspired Processing of Audio-Visua Signals	al 3		
EN.520.353	Control Systems	4		

EN.520.385	Signals, Systems, & Learning	3
EN.520.414	Image Processing & Analysis	3
EN.520.415	Image Process & Analysis II	3
EN.520.432	Medical Imaging Systems	3
EN.520.454	Control Systems Design	3
EN.520.636	Feedback Control in Biological Signaling Pathways	3
EN.530.327	Introduction to Fluid Mechanics	3
EN.530.343	Design and Analysis of Dynamical Systems	3
EN.530.410	Biomechanics of the Cell	3
EN.530.414	Computer-Aided Design	3
EN.530.420	Robot Sensors/Actuators	4
EN.530.426	Biofluid Mechanics	3
EN.530.436	Bioinspired Science and Technology	3
EN.530.445	Introduction to Biomechanics	3
EN.530.448	Biosolid Mechanics	3
EN.540.303	Transport Phenomena I	3
EN.540.304	Transport Phenomena II	4
EN.540.409	Dynamic Modeling and Control	4
EN.540.414	Computational Protein Structure Prediction and	3
LN.340.414	Design	5
EN.540.421	Project in Design: Pharmacodynamics	3
EN.540.432	Project in Design: Pharmacokinetics	3
EN.553.361	Introduction to Optimization	4
EN.553.362	Introduction to Optimization II	4
EN.553.386	Scientific Computing: Differential Equations	4
EN.553.391	Dynamical Systems	4
EN.553.400	Mathematical Modeling and Consulting	4
EN.553.420	Probability	4
	Honors Introduction to Probability	
EN 553 426	Introduction to Stochastic Processes	4
EN.553.430	Mathematical Statistics	4
EN.553.436	Introduction to Data Science	4
EN.553.450	Computational Molecular Medicine	4
EN.553.467	Deep Learning in Discrete Optimization	4
EN.570.351	Introduction to Fluid Mechanics	3
EN.580.418	Principles of Pulmonary Physiology	3
EN.580.430	Systems Pharmacology and Personalized Medicine	4
EN.580.431	Introduction to Computational Medicine: Imaging	2
EN.580.432	Principles of Genomic Systems Engineering and Synthetic Biology	3
EN.580.433	Introduction to Computational Medicine: The Physiome	2
EN.580.439	Models of the Neuron	4
EN.580.441	Cellular Engineering	3
EN.580.444	Biomedical Applications of Glycoengineering	3
EN.580.447	Computational Stem Cell Biology	3
EN.580.454	Methods in Nucleic Acid Sequencing Lab	3
EN.580.459	Seminar in Epigenetic Engineering	1
EN.580.460		1.5
	Epigenetics at the Crossroads of Genes and the Environment	
EN.580.464	Advanced Data Science for Biomedical Engineering	4

EN.580.471	Principles of Design of BME Instrumentation	4
EN.580.480	Precision Care Medicine I	4
EN.580.481	Precision Care Medicine II	4
EN.580.488	Foundations of Computational Biology and Bioinformatics	3
EN.580.491	Learning, Estimation and Control	3
EN.580.571	Honors Instrumentation	2
EN.580.625	Structure and Function of the Auditory and Vestibular Systems	3
EN.580.752	Advanced Topics in Regenerative and Immune Engineering	4
EN.580.688	Foundations of Computational Biology and Bioinformatics	3
EN.601.350	Genomic Data Science	3
EN.601.465	Natural Language Processing	4
EN.601.475	Machine Learning	3
EN.601.476	Machine Learning: Data to Models	3
EN.601.482	Machine Learning: Deep Learning	4
Contact the dep	partment advising office for course additions.	
200-Level Engi	neering Courses	
	3 credits from this list may count in focus area	
EN.520.214	Signals and Systems	4
EN.520.216	Introduction To VLSI	3
EN.520.230	Mastering Electronics	3
EN.520.231	Mastering Electronics Laboratory	2
EN.580.212	Design Team Health-Tech Project II	3
EN.580.298	Advanded Design Team	3
EN.601.226	Data Structures	4
	el Engineering Courses	4
	3 credits from this list may count in focus area	
AS.020.303	Genetics	2
AS.020.303 AS.080.305		3
	Neuroscience: Cellular and Systems I	3
EN.580.112	Design Team Health-Tech Project II	3
	Design Team Health-Tech Project I use a maximum of 3 research credits (courses coded s a non-upper-level engineering course.	3
Imaging and m	nedical devices Focus Area	
		dits
Upper-Level En	gineering Courses	
Upper-Level En	gineering Courses Structure Of Materials	3
Upper-Level En EN.510.311	gineering Courses	
Upper-Level En EN.510.311 EN.510.313	gineering Courses Structure Of Materials	3
Upper-Level En EN.510.311 EN.510.313 EN.510.314	gineering Courses Structure Of Materials Mechanical Properties of Materials	3 3 3
Upper-Level En EN.510.311 EN.510.313 EN.510.314 EN.510.316	gineering Courses Structure Of Materials Mechanical Properties of Materials Electronic Properties of Materials	3 3 3
Upper-Level En EN.510.311 EN.510.313 EN.510.314 EN.510.316 EN.510.407	gineering Courses Structure Of Materials Mechanical Properties of Materials Electronic Properties of Materials Foundations of Biomaterials	3 3 3 3 3 3 3
Upper-Level En EN.510.311 EN.510.313 EN.510.314 EN.510.316 EN.510.407 EN.510.422	gineering Courses Structure Of Materials Mechanical Properties of Materials Electronic Properties of Materials Foundations of Biomaterials Biomaterials Principles and Applications	3 3 3 3
Upper-Level En EN.510.311 EN.510.313 EN.510.314 EN.510.316 EN.510.407 EN.510.422 EN.510.430	gineering Courses Structure Of Materials Mechanical Properties of Materials Electronic Properties of Materials Foundations of Biomaterials Biomaterials Principles and Applications Micro and Nano Structured Materials & Devices	3 3 3 3 3 3
Upper-Level En EN.510.311 EN.510.313 EN.510.314 EN.510.316 EN.510.407 EN.510.422 EN.510.430 EN.510.433	gineering Courses Structure Of Materials Mechanical Properties of Materials Electronic Properties of Materials Foundations of Biomaterials Biomaterials Principles and Applications Micro and Nano Structured Materials & Devices Biomaterials Lab	3 3 3 3 3 3 3 3
Upper-Level En EN.510.311 EN.510.313 EN.510.314 EN.510.316 EN.510.407 EN.510.422 EN.510.430	gineering Courses Structure Of Materials Mechanical Properties of Materials Electronic Properties of Materials Foundations of Biomaterials Biomaterials Principles and Applications Micro and Nano Structured Materials & Devices Biomaterials Lab Materials Characterization Intro. to Bio-Inspired Processing of Audio-Visual	3 3 3 3 3 3 3 3
EN.510.311 EN.510.313 EN.510.314 EN.510.316 EN.510.407 EN.510.422 EN.510.430 EN.510.453 EN.520.315	gineering Courses Structure Of Materials Mechanical Properties of Materials Electronic Properties of Materials Foundations of Biomaterials Biomaterials Principles and Applications Micro and Nano Structured Materials & Devices Biomaterials Lab Materials Characterization Intro. to Bio-Inspired Processing of Audio-Visual Signals	3 3 3 3 3 3 3 3 3 3 3 3
Upper-Level En EN.510.311 EN.510.313 EN.510.314 EN.510.316 EN.510.407 EN.510.422 EN.510.423 EN.510.433 EN.520.315 EN.520.344	gineering Courses Structure Of Materials Mechanical Properties of Materials Electronic Properties of Materials Foundations of Biomaterials Biomaterials Principles and Applications Micro and Nano Structured Materials & Devices Biomaterials Lab Materials Characterization Intro. to Bio-Inspired Processing of Audio-Visual Signals Introduction to Digital Signal Processing	3 3 3 3 3

EN.520.415	Image Process & Analysis II	3	EN.580.457	Introduction to Rehabilitation Engineering: Design
EN.520.417	Computation for Engineers	3		Lab
EN.520.420	Bioelectricity from Neurons to Semiconductors	3	EN.585.717	Rehabilitation Engineering II
EN.520.424	FPGA Synthesis Lab	3	EN.580.464	Advanced Data Science for Biomedical
EN.520.427	Design of Advanced Instruments and Systems	3	EN 500 471	Engineering
EN.520.432	Medical Imaging Systems	3	EN.580.471	Principles of Design of BME Instrumentation
EN.520.433	Medical Image Analysis	3	EN.580.571	Honors Instrumentation
EN.520.447	Information Theory	3	EN.580.479	Principles and Applications of Modern X-ray Imaging and Computed Tomography
EN.520.448	Electronics Design Lab	3	EN.580.491	Learning, Estimation and Control
EN.520.450	Advanced Micro-Processor Lab	3	EN.580.491	Imaging Instrumentation
EN.520.454	Control Systems Design	3	EN.580.493	Build an Imager
EN.520.483	Bio-Photonics Laboratory	3	EN.580.678	Biomedical Photonics I
EN.520.491	CAD Design of Digital VLSI Systems I (Juniors/	3	EN.580.689	Modern Optical Microscopy: Theory and Practice
	Seniors)		EN.580.740	Surgery for Engineers
EN.520.492	Mixed-Mode VLSI Systems	3	EN.580.740	Neural Implants and Interfaces
EN.520.495	Microfabrication Laboratory	4	EN.601.315	Databases
EN.520.631	Ultrasound and Photoacoustic Beamforming	3		Databases
EN.520.646	Wavelets & Filter Banks	3	EN.601.415 EN.601.454	Introduction to Augmented Reality
EN.520.651	Random Signal Analysis	4	EN.601.454	Computer Integrated Surgery I
EN.530.381	Engineering Design Process	3	EN.601.455	
EN.530.414	Computer-Aided Design	3	EN.601.450	Computer Integrated Surgery II Computer Vision
EN.530.420	Robot Sensors/Actuators	4	EN.601.463	Algorithms for Sensor-Based Robotics
EN.530.421	Mechatronics	3	EN.601.475	Machine Learning
EN.530.424	Dynamics of Robots and Spacecraft	3	EN.601.475	Machine Learning Machine Learning: Deep Learning
EN.530.441	Introduction to Biophotonics	3	EN.601.496	Computer Integrated Surgery II - Teams
EN.530.445	Introduction to Biomechanics	3		intment advising office for course additions.
EN.530.468	Locomotion Mechanics: Fundamentals	3	200-Level Engine	-
EN.530.473	Molecular Spectroscopy and Imaging	3	-	credits from this list may count in focus area
EN.530.474	Effective and Economic Design for Biomedical	4	EN.520.214	Signals and Systems
	Instrumentation	4	EN.520.230	Mastering Electronics
EN.530.646	Robot Devices, Kinematics, Dynamics, and Control	4	EN.520.231	Mastering Electronics Laboratory
EN.530.672	Biosensing & BioMEMS	3	EN.530.241	Electronics & Instrumentation
EN.540.403	Colloids and Nanoparticles	3	EN.580.212	Design Team Health-Tech Project II
EN.540.440	Micro/Nanotechnology: The Science and Engineering of Small Structures	3	EN.580.298	Advanded Design Team
EN.553.361	Introduction to Optimization	4	EN.601.226	Data Structures
EN.553.362	Introduction to Optimization	4		Engineering Courses
EN.553.391	Dynamical Systems	4		credits from this list may count in focus area
EN.553.413	Applied Statistics and Data Analysis	4	AS.110.405	Real Analysis I
EN.553.420	Probability	4	AS.110.403	Fourier Analysis
	Honors Introduction to Probability	4	EN.580.112	Design Team Health-Tech Project II
01 LN.333.421	-	4	EN.580.211	Design Team Health-Tech Project I
EN 553 /26	Introduction to Stochastic Processes		LIN.000.211	
	Introduction to Stochastic Processes		Students may us	5
EN.553.426 EN.553.430 EN.553.436	Mathematical Statistics	4	•	e a maximum of 3 research credits (courses coded
EN.553.430 EN.553.436	Mathematical Statistics Introduction to Data Science	4 4	EN.XXX.5XX) as	e a maximum of 3 research credits (courses coded a non-upper-level engineering course.
EN.553.430 EN.553.436 EN.553.433	Mathematical Statistics Introduction to Data Science Monte Carlo Methods	4 4 4	EN.XXX.5XX) as	e a maximum of 3 research credits (courses coded a non-upper-level engineering course. EERING FOCUS AREA
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EN.553.430 EN.553.436 EN.553.433 EN.553.472 EN.553.493 EN.553.630 EN.553.761	Mathematical Statistics Introduction to Data Science Monte Carlo Methods Graph Theory Mathematical Image Analysis Mathematical Statistics Nonlinear Optimization I	4 4 4 4 4 3	EN.XXX.5XX) as IMMUNoENGINI Code Upper-Level Engi EN.510.311 EN.510.312	e a maximum of 3 research credits (courses coded a non-upper-level engineering course. EERING FOCUS AREA Title Creatineering Courses Structure Of Materials Thermodynamics/Materials
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EN.510.316	Foundations of Biomaterials	3
EN.510.407	Biomaterials Principles and Applications	3
EN.510.415	The Chemistry of Polymeric Materials Synthesis	3
EN.510.422	Micro and Nano Structured Materials & Devices	3
EN.510.426	Biomolecular Materials I - Soluble Proteins and Amphiphiles	3
EN.510.430	Biomaterials Lab	3
EN.510.435	Mechanical Properties of Biomaterials	3
EN.510.442	Nanomaterials Lab	3
EN.510.443	Chemistry and Physics of Polymers	3
EN.510.453	Materials Characterization	3
EN.520.495	Microfabrication Laboratory	4
EN.530.410	Biomechanics of the Cell	3
EN.530.426	Biofluid Mechanics	3
EN.530.436	Bioinspired Science and Technology	3
EN.530.445	Introduction to Biomechanics	3
EN.530.448	Biosolid Mechanics	3
EN.540.301	Kinetic Processes	4
EN.540.303	Transport Phenomena I	3
EN.540.304	Transport Phenomena II	4
EN.540.306	Chemical & Biomolecular Separations	4
EN.540.402	Metabolic Systems Biotechnology	3
EN.540.403	Colloids and Nanoparticles	3
EN.540.414	Computational Protein Structure Prediction and Design	3
EN.540.421	Project in Design: Pharmacodynamics	3
EN.540.422	Introduction to Polymeric Materials	3
EN.540.428	Supramolecular Materials and Nanomedicine	3
EN.540.432	Project in Design: Pharmacokinetics	3
EN.540.440	Micro/Nanotechnology: The Science and Engineering of Small Structures	3
EN.540.465	Engineering Principles of Drug Delivery	3
EN.540.602	Metabolic Systems Biotechnology	3
EN.553.386	Scientific Computing: Differential Equations	4
EN.553.391	Dynamical Systems	4
EN.553.413	Applied Statistics and Data Analysis	4
EN.553.420	Probability	4
or EN.553.421	Honors Introduction to Probability	
EN.553.426	Introduction to Stochastic Processes	4
EN.553.430	Mathematical Statistics	4
EN.553.436	Introduction to Data Science	4
EN.553.433	Monte Carlo Methods	4
EN.553.450	Computational Molecular Medicine	4
EN.553.492	Mathematical Biology	3
EN.580.418	Principles of Pulmonary Physiology	3
EN.580.420	Immunomodulatory Biomaterials: Design, Synthesis, and Applications	3
EN.580.430	Systems Pharmacology and Personalized Medicine	4
EN.580.432	Principles of Genomic Systems Engineering and Synthetic Biology	3
EN.580.441	Cellular Engineering	3
EN.580.442	Tissue Engineering	3

EN.580.444	Biomedical Applications of Glycoengineering	3
EN.580.447	Computational Stem Cell Biology	3
EN.580.453	Immunoengineering Principles and Applications with Laboratory	3
EN.580.452	Cell and Tissue Engineering Lab	3
EN.580.464	Advanced Data Science for Biomedical Engineering	4
EN.580.488	Foundations of Computational Biology and Bioinformatics	3
EN.580.454	Methods in Nucleic Acid Sequencing Lab	3
EN.580.646	Molecular Immunoengineering	3
EN.580.752	Advanced Topics in Regenerative and Immune Engineering	4
Contact the de	partment advising office for course additions.	
200-Level Engi	ineering Courses	
A maximum of	3 credits from this list may count in focus area	
EN.580.212	Design Team Health-Tech Project II	3
EN.580.298	Advanded Design Team	3
Non Upper-Lev	el Engineering Courses	
	3 credits from this list may count in focus area	
AS.020.303	Genetics	3
AS.020.337	Stem Cells & the Biology of Aging & Disease	2
AS.020.363	Developmental Biology	3
EN.580.112	Design Team Health-Tech Project II	3
EN.580.211	Design Team Health-Tech Project I	3
	use a maximum of 3 research credits (courses coded is a non-upper-level engineering course.	
	ring Focus Area	
Code	-	edits
Upper-Level Er	ngineering Courses	
EN.520.315	Intro. to Bio-Inspired Processing of Audio-Visual Signals	3
EN.520.344	Introduction to Digital Signal Processing	3
EN.520.349	Microprocessor Lab I	3
EN.520.353	Control Systems	4
EN.520.385	Signals, Systems, & Learning	3
EN.520.412	Machine Learning for Signal Processing	3
EN.520.424	FPGA Synthesis Lab	3
EN.520.432	Medical Imaging Systems	3
EN.520.445	Audio Signal Processing	3
EN.520.448	Electronics Design Lab	3
EN.520.450	Advanced Micro-Processor Lab	3
EN.520.454	Control Systems Design	3
EN.520.491	CAD Design of Digital VLSI Systems I (Juniors/ Seniors)	3
EN.520.492	Mixed-Mode VLSI Systems	3
	Misusfahulaatian Lahaustamu	4

Microfabrication Laboratory

Computer-Aided Design

Mechatronics

Robot Sensors/Actuators

Introduction to Biomechanics

Locomotion Mechanics: Fundamentals

Robot Devices, Kinematics, Dynamics, and Control

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EN.520.495

EN.530.414

EN.530.420

EN.530.421

EN.530.445

EN.530.468

EN.530.646

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EN.310.311 Structure of Materials 3			0			
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EN.580.453	Immunoengineering Principles and Applications with Laboratory	3
EN.580.454	Methods in Nucleic Acid Sequencing Lab	3
EN.580.456	Introduction to Rehabilitation Engineering	3
EN.580.457	Introduction to Rehabilitation Engineering: Design Lab	3
EN.585.717	Rehabilitation Engineering II	3
EN.580.643	Advanced Orthopaedic Tissue Engineering	3
EN.580.646	Molecular Immunoengineering	3
Contact the depa	artment advising office for course additions.	
200-Level Engin	eering Courses	
A maximum of 3	credits from this list may count in focus area	
EN.580.212	Design Team Health-Tech Project II	3
EN.580.298	Advanded Design Team	3
Non Upper-Leve	l Engineering Courses	
A maximum of 3	credits from this list may count in focus area	
AS.020.303	Genetics	3
AS.020.337	Stem Cells & the Biology of Aging & Disease	2
AS.020.363	Developmental Biology	3
EN.580.112	Design Team Health-Tech Project II	3
EN.580.211	Design Team Health-Tech Project I	3
Students may us	se a maximum of 3 research credits (courses coded	

EN.XXX.5XX) as a non-upper-level engineering course.

Sample Program

First Yea	r
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First Semester	Credits Second Semester	Credits
AS.110.108	4 AS.110.109	4
AS.030.101	3 AS.030.102	3
AS.030.105	1 AS.030.106	1
AS.171.101	4 AS.171.102	4
AS.173.111	1 AS.173.112	1
EN.500.112, 113, or 114	3 EN.580.151	3
EN.580.111	2 EN.580.153	1
	18	17
Second Year		
First Semester	Credits Second Semester	Credits
AS.110.202	4 EN.553.311 (or see list of statistics options)	4
EN.553.291	4 EN.580.242	2

EN.580.2432 EN.580.2482Humanities/Social Science Elective31615Third YearCredits Second SemesterCreditsFirst SemesterCredits Second Semester3EN.580.4752 EN.580.4xx Core Elective3EN.580.4771 EN.580.4xx Core Elective3EN.580.4852 BME Focus Area Elective3	EN.580.2412 EN.580.2462EN.580.2432 EN.580.2482Humanities/Social Science Elective3Elective1615Third YearFirst SemesterCredits 2 EN.580.4xx Core ElectiveCredits Second SemesterCredits 3	EN.580.241 2 EN.580.246 2 EN.580.243 2 EN.580.248 2 Humanities/Social Science Elective 3 3 Third Year 16 15 First Semester Credits Second Semester Credits EN.580.475 2 EN.580.4xx Core Elective 3 EN.580.477 1 EN.580.4xx Core Elective 3 3 EN.580.485 2 BME Focus Area Elective 3 EN.580.487 1 Humanities/Social Science 3	EN.553.291	4 EN.580.242	2
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EN.580.487 1 Humanities/Social Science 3	LIN. SOU.477 I EIN. SOU.47X COTE Elective S	EN.580.487 1 Humanities/Social Science 3	EN.580.477	1 EN.580.4xx Core Elective	3
	EN.580.485 2 BME Focus Area Elective 3		EN.580.485	2 BME Focus Area Elective	3
		Elective	EN 580 487	1 Humanities/Social Science	3

BME Focus Area Elective	3 Humanities/Social Science Elective	3
Humanities/Social Science Elective	3 Free Elective	3
Free Elective	3	
	15	18
Fourth Year		
First Semester	Credits Second Semester	Credits
BME Focus Area Elective	3 BME Focus Area Elective	3
BME Focus Area Elective	3 BME Focus Area Elective	3
BME Design Sequence (see list of options)	3 BME Focus Area Elective	3
Humanities/Social Science Elective	3 BME Design Sequence (continuation)	3
Free Elective	3 Humanities/Social Science Elective	3
	15	15
- · · · · · · ·		

Total Credits 129

Sample Program for Pre-Meds

1 5		
First Year		
First Semester	Credits Second Semester	Credits
AS.110.108	4 AS.110.109	4
AS.030.101	3 AS.030.102	3
AS.030.105	1 AS.030.106	1
AS.171.101	4 AS.171.102	4
AS.173.111	1 AS.173.112	1
EN.500.112, 113, or 114	3 EN.580.151	3
EN.580.111	2 EN.580.153	1
	18	17
Second Year		
First Semester	Credits Second Semester	Credits
AS.030.205	4 AS.110.202	4
EN.553.291	4 EN.580.242	2
EN.580.221	4 EN.580.244	2
Humanities/Social Science Elective	3 AS.030.206	4
Humanities/Social Science Elective	3 AS.030.225	3
	18	15
Third Year		
First Semester	Credits Second Semester	Credits
EN.553.311	4 EN.580.246	2
EN.580.241	2 EN.580.248	2
EN.580.243	2 BME Focus Area Elective	3
BME Focus Area Elective	3 BME Focus Area Elective	3
Humanities/Social Science Elective	3 Humanities/Social Science Elective	3
Humanities/Social Science Elective	3 Humanities/Social Science Elective	3
	17	16

Fourth Year		
First Semester	Credits Second Semester	Credits
EN.580.475	2 EN.580.4xx Core Elective	3
EN.580.477	1 EN.580.4xx Core Elective	3
EN.580.485	2 BME Focus Area Elective	3
EN.580.487	1 BME Focus Area Elective	3
BME Focus Area Elective	3 BME Design Sequence (continuation)	3
BME Focus Area Elective	3	
BME Design Sequence (see list of options)	3	
	15	15

Total Credits 131

Sample Program with Calculus I & II Credits

First Year Credits **First Semester Credits Second Semester** AS.110.202 4 EN.553.291 4 AS.030.101 3 AS.030.102 3 AS.030.105 1 AS.030.106 1 AS.171.101 4 AS.171.102 4 AS.173.111 1 AS.173.112 1 3 EN.500.112, 113, or 114 3 EN.580.151 EN.580.111 2 EN.580.153 1 17 18 Second Year **First Semester Credits Second Semester** Credits EN.553.311 4 EN.580.242 2 EN.580.221 4 EN.580.244 2 EN.580.241 2 EN.580.246 2 EN.580.243 2 EN.580.248 2 Humanities/Social Science **3 BME Focus Area Elective** 3 Elective Humanities/Social Science 3 Elective Free Elective 3 15 17 **Third Year First Semester Credits Second Semester** Credits EN.580.475 3 2 EN.580.4xx Core Elective EN.580.477 1 EN.580.4xx Core Elective 3 EN.580.485 2 BME Focus Area Elective 3 EN.580.487 1 Humanities/Social Science 3 Elective **BME Focus Area Elective 3 Free Elective** 3 Humanities/Social Science 3 Elective Free Elective 3 15 15

Fourth Year

First Semester	Credits Second Semester	Credits
BME Focus Area Elective	3 BME Focus Area Elective	3
BME Focus Area Elective	3 BME Focus Area Elective	3
BME Design Sequence (see list of options)	3 BME Design Sequence (continuation)	3
Humanities/Social Science Elective	3 Humanities/Social Science Elective	3
	12	12

Total Credits 121

Total Credits: 129 after 8 exam/transfer credits are applied (Calculus I and II).

Sample Program for Pre-Meds with Calculus I & II Credits

First Year		
First Semester	Credits Second Semester	Credits
AS.110.202	4 EN.553.291	4
AS.030.101	3 AS.030.102	3
AS.030.105	1 AS.030.105	1
AS.171.101	4 AS.171.102	4
AS.173.111	1 AS.173.112	1
EN.500.112, 113, or 114	3 EN.580.151	3
EN.580.111	2 EN.580.153	1
	18	17
Second Year		
First Semester	Credits Second Semester	Credits
EN.553.311 (or see list of statistics options)	4 EN.580.242	2
EN.580.221	4 EN.580.244	2
EN.580.241	2 EN.580.246	2
EN.580.243	2 EN.580.248	2
AS.030.205	4 AS.030.205	4
	AS.030.225	3
	16	15
Third Year		
First Semester	Credits Second Semester	Credits
EN.580.475	2 EN.580.4xx Core Elective	3
EN.580.477	1 EN.580.4xx Core Elective	3
EN.580.485	2 BME Focus Area Elective	3
EN.580.487	1 Humanities/Social Science Elective	3
BME Focus Area Elective	3 Humanities/Social Science Elective	3
BME Focus Area Elective Humanities/Social Science Elective		3
Humanities/Social Science	Elective	3
Humanities/Social Science Elective Humanities/Social Science	Elective 3	3
Humanities/Social Science Elective Humanities/Social Science	Elective 3 3	_
Humanities/Social Science Elective Humanities/Social Science Elective	Elective 3 3	_

15	10
3	
3 Humanities/Social Science Elective	3
3 BME Design Sequence (continuation)	3
3 BME Focus Area Elective	3
	3 BME Design Sequence (continuation) 3 Humanities/Social Science Elective

Total Credits 123

Total Credits: 131 credits after 8 exam/transfer credits are applied (Calculus I and II).

Sample Program for 3+1 Program with 24 Credits

First Year

First Semester AS.110.202	Credits Second Semester 4 EN.553.311 (or see list of	Credits 4
A3.110.202	statistics options)	4
EN.500.112, 113, or 114	3 EN.580.151	3
EN.553.291	4 EN.580.153	1
EN.580.111	2 Humanities/Social Science Elective	3
Humanities/Social Science Elective	Humanities/Social Science Elective	3
Free Elective (for waived/no credit Physics Labs)	2 Free Elective	3
	15	17
Second Year		
First Semester	Credits Second Semester	Credits
EN.580.221	4 EN.580.242	2
EN.580.241	2 EN.580.244	2
EN.580.243	2 EN.580.246	2
BME Focus Area Elective	3 EN.580.248	2
Humanities/Social Science Elective	3 BME Focus Area Elective	3
Humanities/Social Science Elective	3 Humanities/Social Science Elective	3
	Free Elective	3
	17	17
Third Year		
First Semester	Credits Second Semester	Credits
EN.580.475	2 EN.580.4xx Core Elective	3
EN.580.477	1 EN.580.4xx Core Elective	3
EN.580.485	2 BME Focus Area Elective	3
EN.580.487	1 BME Focus Area Elective	3
BME Focus Area Elective	3 BME Design Sequence (continuation)	3
BME Focus Area Elective	3 Free Elective	3
BME Design Sequence (see list of options)	3	
	15	18

Credits Second Semester	Credits
3 BME Focus Area Elective	3
3 MSE Course	3
3 MSE Course	3
3 MSE Course	3
3	
15	12
	3 BME Focus Area Elective 3 MSE Course 3 MSE Course 3 MSE Course 3 S

Total Credits 126

Total Credits: 150 after 24 relevant exam/transfer credits are applied (Calculus I and II, Chemistry I and II with labs, Physics I and II with labs).

Sample Program for 3+1 Program for Pre-Meds with 24 Credits

First Year		
First Semester	Credits Second Semester	Credits
AS.110.202	4 EN.553.311 (or see list of statistics options)	4
EN.553.291	4 EN.580.151	3
EN.500.112, 113, or 114	3 EN.580.153	1
EN.580.111	2 AS.030.206	4
AS.030.205	4 AS.030.225	3
	Humanities/Social Science Elective	3
	17	18
Second Year		
First Semester	Credits Second Semester	Credits
EN.580.221	4 EN.580.242	2
EN.580.241	2 EN.580.244	2
EN.580.243	2 EN.580.246	2
BME Focus Area Elective	3 EN.580.248	2
Humanities/Social Science Elective	3 BME Focus Area Elective	3
Humanities/Social Science Elective	3 Humanities/Social Science Elective	3
	Humanities/Social Science Elective	3
	17	17
Third Year		
First Semester	Credits Second Semester	Credits
EN.580.475	2 EN.580.4xx Core Elective	3
EN.580.477	1 EN.580.4xx Core Elective	3
EN.580.485	2 BME Focus Area Elective	3
EN.580.487	1 BME Focus Area Elective	3
BME Focus Area Elective	3 BME Focus Area Elective	3
BME Design Sequence (see list of options)	3 BME Design Sequence (continuation)	3
Humanities/Social Science Elective	3	
	15	18

Fourth Year		
First Semester	Credits Second Semester	Credits
MSE Course	3 BME Focus Area Elective	3
MSE Course	3 MSE Course	3
MSE Course	3 MSE Course	3
MSE Course	3 MSE Course	3
MSE Course	3	
	15	12
Total Cradita 120		

Total Credits 129

Total Credits: 153 after 24 relevant exam/transfer credits are applied (Calculus I and II, Chemistry I and II with labs, Physics I and II with labs).