

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://e-catalogue.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	Title	Credits
Basic Sciences ¹		
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-level or higher.³ 18

Biomedical Core

EN.580.111	Biomedical Engineering and Design	2
EN.580.151	Structural Biology of Cells	3
EN.580.153	Structural Biology of Cells Laboratory	1
EN.580.221	Biochemistry and Molecular Engineering	4
EN.580.241	Statistical Physics	2
EN.580.242	Biological Models and Simulations	2
EN.580.243	Linear Signals and Systems	2
EN.580.244	Nonlinear Dynamics of Biological Systems	2
EN.580.246	Systems and Controls	2
EN.580.248	Systems Biology of the Cell	2
EN.580.475	Biomedical Data Science	2
EN.580.477	Biomedical Data Science Laboratory	1
EN.580.485	Computational Medicine: Cardiology	2
EN.580.487	Computational Medicine: Cardiology Laboratory	1

Select two of the following core electives:⁴ 6

EN.580.424	Neuroengineering and Lab	
EN.580.427	Microphysiological Systems and Laboratory	
EN.580.452	Cell and Tissue Engineering Lab	
EN.580.453	Immunoengineering Principles and Applications with Laboratory	
EN.580.454	Methods in Nucleic Acid Sequencing Lab	
EN.580.494	Build an Imager	

Career Exploration in BME⁵

Focus Area

Select one of the following: 21

Biomedical Data Science (p. 3)	
Computational Medicine (p. 4)	
Genomics and Systems Biology (p. 4)	
Imaging and Medical Devices (p. 5)	
Immunoengineering (p. 6)	
Neuroengineering (p. 7)	
Translational Cell and Tissue Engineering (p. 8)	

Design

⁶

Select at least one of the following design sequences: 6

EN.510.433	Senior Design Research	
& EN.510.434	and Senior Design/Research II (This option must be approved by the Materials Science & Engineering Department)	
EN.520.363	ECE Ideation and Design Lab	
& 363	and ECE Ideation and Design Lab ⁷	
EN.520.463	ECE Ideation and Design Lab	
& 463	and ECE Ideation and Design Lab ⁸	
EN.540.421	Project in Design: Pharmacodynamics	
& EN.540.432	and Project in Design: Pharmacokinetics	
EN.580.311	Design Team Health-Tech Project I	
& EN.580.312	and Design Team Health-Tech Project II	
EN.580.411	Design Team Health-Tech Project I	
& EN.580.412	and Design Team Health-Tech Project II	
EN.580.437	Biomedical Data Design	
& EN.580.438	and Biomedical Data Design II	

EN.580.456 & EN.580.457	Introduction to Rehabilitation Engineering and Introduction to Rehabilitation Engineering: Design Lab	
	or EN.585.71 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	Computer Integrated Surgery I and Computer Integrated Surgery II	
	or EN.601.45 Computer Integrated Surgery II - Teams	
EN.660.345 & EN.660.346	Multidisciplinary Engineering Design 1 and Multidisciplinary Engineering Design 2	

Computer Programming

EN.500.112	Gateway Computing: JAVA	3
	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. 9

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://e-catalogue.jhu.edu/engineering/full-time-residential-programs/undergraduate-policies/academic-policies/requirements-bachelors-degree/#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 career-related 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

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 Engineering 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.601.456	Computer Integrated Surgery II	3
EN.601.457	Computer Graphics	3
EN.601.461	Computer Vision	3
EN.601.463	Algorithms for Sensor-Based Robotics	3
EN.601.464	Artificial Intelligence	3
EN.601.465	Natural Language Processing	4
EN.601.466	Information Retrieval and Web Agents	3
EN.601.474	ML: Learning Theory	3
EN.601.475	Machine Learning	3
EN.601.476	Machine Learning: Data to Models	3
EN.601.477	Causal Inference	3
EN.601.482	Machine Learning: Deep Learning	4
EN.601.491	Human-Robot Interaction	3

Contact the department advising office for course additions.

200-Level Engineering 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	Advanced Design Team	3
EN.601.226	Data Structures	4
EN.601.229	Computer System Fundamentals	3

Non Upper-Level Engineering Courses

A maximum of 3 credits from this list may count in focus area

AS.110.311	Methods of Complex Analysis	4
AS.110.405	Real Analysis I	4
AS.110.421	Dynamical Systems	4
AS.110.443	Fourier Analysis	4
EN.580.112	Design Team Health-Tech Project II	3
EN.580.211	Design Team Health-Tech Project I	3
EN.601.231	Automata & Computation Theory	3

Students may use a maximum of 3 research credits (courses coded EN.XXX.5XX) as a non-upper-level engineering course.

Computational Medicine Focus Area

Code	Title	Credits
Upper-Level Engineering Courses		
EN.520.315	Intro. to Bio-Inspired Processing of Audio-Visual Signals	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 department advising office for course additions.

200-Level Engineering 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	Advanced 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 Engineering Courses

A maximum of 3 credits 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

Students may use a maximum of 3 research credits (courses coded EN.XXX.5XX) as a 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-Visual Signals	3
EN.520.353	Control Systems	4

EN.520.385	Signals, Systems, & Learning	3	EN.580.471	Principles of Design of BME Instrumentation	4
EN.520.414	Image Processing & Analysis	3	EN.580.480	Precision Care Medicine I	4
EN.520.415	Image Process & Analysis II	3	EN.580.481	Precision Care Medicine II	4
EN.520.432	Medical Imaging Systems	3	EN.580.488	Foundations of Computational Biology and Bioinformatics	3
EN.520.454	Control Systems Design	3	EN.580.491	Learning, Estimation and Control	3
EN.520.636	Feedback Control in Biological Signaling Pathways	3	EN.580.571	Honors Instrumentation	2
EN.530.327	Introduction to Fluid Mechanics	3	EN.580.625	Structure and Function of the Auditory and Vestibular Systems	3
EN.530.343	Design and Analysis of Dynamical Systems	3	EN.580.752	Advanced Topics in Regenerative and Immune Engineering	4
EN.530.410	Biomechanics of the Cell	3	EN.580.688	Foundations of Computational Biology and Bioinformatics	3
EN.530.414	Computer-Aided Design	3	EN.601.350	Genomic Data Science	3
EN.530.420	Robot Sensors/Actuators	4	EN.601.465	Natural Language Processing	4
EN.530.426	Biofluid Mechanics	3	EN.601.475	Machine Learning	3
EN.530.436	Bioinspired Science and Technology	3	EN.601.476	Machine Learning: Data to Models	3
EN.530.445	Introduction to Biomechanics	3	EN.601.482	Machine Learning: Deep Learning	4
EN.530.448	Biosolid Mechanics	3	Contact the department advising office for course additions.		
EN.540.303	Transport Phenomena I	3	200-Level Engineering Courses		
EN.540.304	Transport Phenomena II	4	A maximum of 3 credits from this list may count in focus area		
EN.540.409	Dynamic Modeling and Control	4	EN.520.214	Signals and Systems	4
EN.540.414	Computational Protein Structure Prediction and Design	3	EN.520.216	Introduction To VLSI	3
EN.540.421	Project in Design: Pharmacodynamics	3	EN.520.230	Mastering Electronics	3
EN.540.432	Project in Design: Pharmacokinetics	3	EN.520.231	Mastering Electronics Laboratory	2
EN.553.361	Introduction to Optimization	4	EN.580.212	Design Team Health-Tech Project II	3
EN.553.362	Introduction to Optimization II	4	EN.580.298	Advanced Design Team	3
EN.553.386	Scientific Computing: Differential Equations	4	EN.601.226	Data Structures	4
EN.553.391	Dynamical Systems	4	Non Upper-Level Engineering Courses		
EN.553.400	Mathematical Modeling and Consulting	4	A maximum of 3 credits from this list may count in focus area		
EN.553.420	Probability	4	AS.020.303	Genetics	3
or EN.553.421	Honors Introduction to Probability		AS.080.305	Neuroscience: Cellular and Systems I	3
EN.553.426	Introduction to Stochastic Processes	4	EN.580.112	Design Team Health-Tech Project II	3
EN.553.430	Mathematical Statistics	4	EN.580.211	Design Team Health-Tech Project I	3
EN.553.436	Introduction to Data Science	4	Students may use a maximum of 3 research credits (courses coded EN.XXX.5XX) as a non-upper-level engineering course.		
EN.553.450	Computational Molecular Medicine	4	Imaging and medical devices Focus Area		
EN.553.467	Deep Learning in Discrete Optimization	3	Code	Title	Credits
EN.570.351	Introduction to Fluid Mechanics	3	Upper-Level Engineering Courses		
EN.580.418	Principles of Pulmonary Physiology	3	EN.510.311	Structure Of Materials	3
EN.580.430	Systems Pharmacology and Personalized Medicine	4	EN.510.313	Mechanical Properties of Materials	3
EN.580.431	Introduction to Computational Medicine: Imaging	2	EN.510.314	Electronic Properties of Materials	3
EN.580.432	Principles of Genomic Systems Engineering and Synthetic Biology	3	EN.510.316	Foundations of Biomaterials	3
EN.580.433	Introduction to Computational Medicine: The Physiome	2	EN.510.407	Biomaterials Principles and Applications	3
EN.580.439	Models of the Neuron	4	EN.510.422	Micro and Nano Structured Materials & Devices	3
EN.580.441	Cellular Engineering	3	EN.510.430	Biomaterials Lab	3
EN.580.444	Biomedical Applications of Glycoengineering	3	EN.510.453	Materials Characterization	3
EN.580.447	Computational Stem Cell Biology	3	EN.520.315	Intro. to Bio-Inspired Processing of Audio-Visual Signals	3
EN.580.454	Methods in Nucleic Acid Sequencing Lab	3	EN.520.344	Introduction to Digital Signal Processing	3
EN.580.459	Seminar in Epigenetic Engineering	1	EN.520.349	Microprocessor Lab I	3
EN.580.460	Epigenetics at the Crossroads of Genes and the Environment	1.5	EN.520.353	Control Systems	4
EN.580.464	Advanced Data Science for Biomedical Engineering	4	EN.520.414	Image Processing & Analysis	3

EN.520.415	Image Process & Analysis II	3	EN.580.457	Introduction to Rehabilitation Engineering: Design Lab	3
EN.520.417	Computation for Engineers	3	EN.585.717	Rehabilitation Engineering II	3
EN.520.420	Bioelectricity from Neurons to Semiconductors	3	EN.580.464	Advanced Data Science for Biomedical Engineering	4
EN.520.424	FPGA Synthesis Lab	3	EN.580.471	Principles of Design of BME Instrumentation	4
EN.520.427	Design of Advanced Instruments and Systems	3	EN.580.571	Honors Instrumentation	2
EN.520.432	Medical Imaging Systems	3	EN.580.479	Principles and Applications of Modern X-ray Imaging and Computed Tomography	3
EN.520.433	Medical Image Analysis	3	EN.580.491	Learning, Estimation and Control	3
EN.520.447	Information Theory	3	EN.580.493	Imaging Instrumentation	4
EN.520.448	Electronics Design Lab	3	EN.580.494	Build an Imager	3
EN.520.450	Advanced Micro-Processor Lab	3	EN.580.678	Biomedical Photonics I	4
EN.520.454	Control Systems Design	3	EN.580.689	Modern Optical Microscopy: Theory and Practice	3
EN.520.483	Bio-Photonics Laboratory	3	EN.580.740	Surgery for Engineers	3
EN.520.491	CAD Design of Digital VLSI Systems I (Juniors/Seniors)	3	EN.580.742	Neural Implants and Interfaces	3
EN.520.492	Mixed-Mode VLSI Systems	3	EN.601.315	Databases	3
EN.520.495	Microfabrication Laboratory	4	EN.601.415	Databases	3
EN.520.631	Ultrasound and Photoacoustic Beamforming	3	EN.601.454	Introduction to Augmented Reality	3
EN.520.646	Wavelets & Filter Banks	3	EN.601.455	Computer Integrated Surgery I	4
EN.520.651	Random Signal Analysis	4	EN.601.456	Computer Integrated Surgery II	3
EN.530.381	Engineering Design Process	3	EN.601.461	Computer Vision	3
EN.530.414	Computer-Aided Design	3	EN.601.463	Algorithms for Sensor-Based Robotics	3
EN.530.420	Robot Sensors/Actuators	4	EN.601.475	Machine Learning	3
EN.530.421	Mechatronics	3	EN.601.482	Machine Learning: Deep Learning	4
EN.530.424	Dynamics of Robots and Spacecraft	3	EN.601.496	Computer Integrated Surgery II - Teams	3
EN.530.441	Introduction to Biophotonics	3	Contact the department advising office for course additions.		
EN.530.445	Introduction to Biomechanics	3	200-Level Engineering Courses		
EN.530.468	Locomotion Mechanics: Fundamentals	3	A maximum of 3 credits from this list may count in focus area		
EN.530.473	Molecular Spectroscopy and Imaging	3	EN.520.214	Signals and Systems	4
EN.530.474	Effective and Economic Design for Biomedical Instrumentation	4	EN.520.230	Mastering Electronics	3
EN.530.646	Robot Devices, Kinematics, Dynamics, and Control	4	EN.520.231	Mastering Electronics Laboratory	2
EN.530.672	Biosensing & BioMEMS	3	EN.530.241	Electronics & Instrumentation	3
EN.540.403	Colloids and Nanoparticles	3	EN.580.212	Design Team Health-Tech Project II	3
EN.540.440	Micro/Nanotechnology: The Science and Engineering of Small Structures	3	EN.580.298	Advanced Design Team	3
EN.553.361	Introduction to Optimization	4	EN.601.226	Data Structures	4
EN.553.362	Introduction to Optimization II	4	Non Upper-Level Engineering Courses		
EN.553.391	Dynamical Systems	4	A maximum of 3 credits from this list may count in focus area		
EN.553.413	Applied Statistics and Data Analysis	4	AS.110.405	Real Analysis I	4
EN.553.420	Probability	4	AS.110.443	Fourier Analysis	4
or EN.553.421	Honors Introduction to Probability		EN.580.112	Design Team Health-Tech Project II	3
EN.553.426	Introduction to Stochastic Processes	4	EN.580.211	Design Team Health-Tech Project I	3
EN.553.430	Mathematical Statistics	4	Students may use a maximum of 3 research credits (courses coded EN.XXX.5XX) as a non-upper-level engineering course.		
EN.553.436	Introduction to Data Science	4	IMMUNoENGINEERING FOCUS AREA		
EN.553.433	Monte Carlo Methods	4	Code	Title	Credits
EN.553.472	Graph Theory	4	Upper-Level Engineering Courses		
EN.553.493	Mathematical Image Analysis	4	EN.510.311	Structure Of Materials	3
EN.553.630	Mathematical Statistics	4	EN.510.312	Thermodynamics/Materials	3
EN.553.761	Nonlinear Optimization I	3	EN.510.313	Mechanical Properties of Materials	3
EN.553.762	Nonlinear Optimization II	3	EN.510.314	Electronic Properties of Materials	3
EN.580.425	Radiology for Engineers	3	EN.510.315	Physical Chemistry of Materials II	3
EN.580.435	Applied Bioelectrical Engineering	3			
EN.580.456	Introduction to Rehabilitation Engineering	3			

EN.510.316	Foundations of Biomaterials	3	EN.580.444	Biomedical Applications of Glycoengineering	3
EN.510.407	Biomaterials Principles and Applications	3	EN.580.447	Computational Stem Cell Biology	3
EN.510.415	The Chemistry of Polymeric Materials Synthesis	3	EN.580.453	Immunoengineering Principles and Applications with Laboratory	3
EN.510.422	Micro and Nano Structured Materials & Devices	3	EN.580.452	Cell and Tissue Engineering Lab	3
EN.510.426	Biomolecular Materials I - Soluble Proteins and Amphiphiles	3	EN.580.464	Advanced Data Science for Biomedical Engineering	4
EN.510.430	Biomaterials Lab	3	EN.580.488	Foundations of Computational Biology and Bioinformatics	3
EN.510.435	Mechanical Properties of Biomaterials	3	EN.580.454	Methods in Nucleic Acid Sequencing Lab	3
EN.510.442	Nanomaterials Lab	3	EN.580.646	Molecular Immunoengineering	3
EN.510.443	Chemistry and Physics of Polymers	3	EN.580.752	Advanced Topics in Regenerative and Immune Engineering	4
EN.510.453	Materials Characterization	3	Contact the department advising office for course additions.		
EN.520.495	Microfabrication Laboratory	4	200-Level Engineering Courses		
EN.530.410	Biomechanics of the Cell	3	A maximum of 3 credits from this list may count in focus area		
EN.530.426	Biofluid Mechanics	3	EN.580.212	Design Team Health-Tech Project II	3
EN.530.436	Bioinspired Science and Technology	3	EN.580.298	Advanced Design Team	3
EN.530.445	Introduction to Biomechanics	3	Non Upper-Level Engineering Courses		
EN.530.448	Biosolid Mechanics	3	A maximum of 3 credits from this list may count in focus area		
EN.540.301	Kinetic Processes	4	AS.020.303	Genetics	3
EN.540.303	Transport Phenomena I	3	AS.020.337	Stem Cells & the Biology of Aging & Disease	2
EN.540.304	Transport Phenomena II	4	AS.020.363	Developmental Biology	3
EN.540.306	Chemical & Biomolecular Separations	4	EN.580.112	Design Team Health-Tech Project II	3
EN.540.402	Metabolic Systems Biotechnology	3	EN.580.211	Design Team Health-Tech Project I	3
EN.540.403	Colloids and Nanoparticles	3	Students may use a maximum of 3 research credits (courses coded EN.XXX.5XX) as a non-upper-level engineering course.		
EN.540.414	Computational Protein Structure Prediction and Design	3	Neuroengineering Focus Area		
EN.540.421	Project in Design: Pharmacodynamics	3	Code	Title	Credits
EN.540.422	Introduction to Polymeric Materials	3	Upper-Level Engineering Courses		
EN.540.428	Supramolecular Materials and Nanomedicine	3	EN.520.315	Intro. to Bio-Inspired Processing of Audio-Visual Signals	3
EN.540.432	Project in Design: Pharmacokinetics	3	EN.520.344	Introduction to Digital Signal Processing	3
EN.540.440	Micro/Nanotechnology: The Science and Engineering of Small Structures	3	EN.520.349	Microprocessor Lab I	3
EN.540.465	Engineering Principles of Drug Delivery	3	EN.520.353	Control Systems	4
EN.540.602	Metabolic Systems Biotechnology	3	EN.520.385	Signals, Systems, & Learning	3
EN.553.386	Scientific Computing: Differential Equations	4	EN.520.412	Machine Learning for Signal Processing	3
EN.553.391	Dynamical Systems	4	EN.520.424	FPGA Synthesis Lab	3
EN.553.413	Applied Statistics and Data Analysis	4	EN.520.432	Medical Imaging Systems	3
EN.553.420	Probability	4	EN.520.445	Audio Signal Processing	3
or EN.553.421	Honors Introduction to Probability		EN.520.448	Electronics Design Lab	3
EN.553.426	Introduction to Stochastic Processes	4	EN.520.450	Advanced Micro-Processor Lab	3
EN.553.430	Mathematical Statistics	4	EN.520.454	Control Systems Design	3
EN.553.436	Introduction to Data Science	4	EN.520.491	CAD Design of Digital VLSI Systems I (Juniors/Seniors)	3
EN.553.433	Monte Carlo Methods	4	EN.520.492	Mixed-Mode VLSI Systems	3
EN.553.450	Computational Molecular Medicine	4	EN.520.495	Microfabrication Laboratory	4
EN.553.492	Mathematical Biology	3	EN.530.414	Computer-Aided Design	3
EN.580.418	Principles of Pulmonary Physiology	3	EN.530.420	Robot Sensors/Actuators	4
EN.580.420	Immunomodulatory Biomaterials: Design, Synthesis, and Applications	3	EN.530.421	Mechatronics	3
EN.580.430	Systems Pharmacology and Personalized Medicine	4	EN.530.445	Introduction to Biomechanics	3
EN.580.432	Principles of Genomic Systems Engineering and Synthetic Biology	3	EN.530.468	Locomotion Mechanics: Fundamentals	3
EN.580.441	Cellular Engineering	3	EN.530.646	Robot Devices, Kinematics, Dynamics, and Control	4
EN.580.442	Tissue Engineering	3			

EN.530.672	Biosensing & BioMEMS	3	EN.510.312	Thermodynamics/Materials	3
EN.540.403	Colloids and Nanoparticles	3	EN.510.313	Mechanical Properties of Materials	3
EN.540.440	Micro/Nanotechnology: The Science and Engineering of Small Structures	3	EN.510.314	Electronic Properties of Materials	3
EN.580.424	Neuroengineering and Lab	3	EN.510.315	Physical Chemistry of Materials II	3
EN.580.426	Neuroengineering: The Neural Control of Movement	3	EN.510.316	Foundations of Biomaterials	3
EN.580.432	Principles of Genomic Systems Engineering and Synthetic Biology	3	EN.510.407	Biomaterials Principles and Applications	3
EN.580.437	Biomedical Data Design	4	EN.510.415	The Chemistry of Polymeric Materials Synthesis	3
EN.580.438	Biomedical Data Design II	4	EN.510.422	Micro and Nano Structured Materials & Devices	3
EN.580.441	Cellular Engineering	3	EN.510.426	Biomolecular Materials I - Soluble Proteins and Amphiphiles	3
EN.580.442	Tissue Engineering	3	EN.510.430	Biomaterials Lab	3
EN.580.452	Cell and Tissue Engineering Lab	3	EN.510.435	Mechanical Properties of Biomaterials	3
EN.580.456	Introduction to Rehabilitation Engineering	3	EN.510.436	Biomaterials for Cell Engineering	3
EN.580.457	Introduction to Rehabilitation Engineering: Design Lab	3	EN.510.442	Nanomaterials Lab	3
EN.585.717	Rehabilitation Engineering II	3	EN.510.443	Chemistry and Physics of Polymers	3
EN.580.471	Principles of Design of BME Instrumentation	4	EN.510.453	Materials Characterization	3
EN.580.571	Honors Instrumentation	2	EN.520.495	Microfabrication Laboratory	4
EN.580.488	Foundations of Computational Biology and Bioinformatics	3	EN.530.410	Biomechanics of the Cell	3
EN.580.491	Learning, Estimation and Control	3	EN.530.426	Biofluid Mechanics	3
EN.580.493	Imaging Instrumentation	4	EN.530.436	Bioinspired Science and Technology	3
EN.580.494	Build an Imager	3	EN.530.445	Introduction to Biomechanics	3
EN.580.688	Foundations of Computational Biology and Bioinformatics	3	EN.530.448	Biosolid Mechanics	3
EN.580.689	Modern Optical Microscopy: Theory and Practice	3	EN.530.468	Locomotion Mechanics: Fundamentals	3
EN.580.742	Neural Implants and Interfaces	3	EN.530.474	Effective and Economic Design for Biomedical Instrumentation	4
EN.601.455	Computer Integrated Surgery I	4	EN.540.301	Kinetic Processes	4
EN.601.456	Computer Integrated Surgery II	3	EN.540.303	Transport Phenomena I	3
EN.601.475	Machine Learning	3	EN.540.304	Transport Phenomena II	4
EN.601.482	Machine Learning: Deep Learning	4	EN.540.306	Chemical & Biomolecular Separations	4
EN.601.496	Computer Integrated Surgery II - Teams	3	EN.540.402	Metabolic Systems Biotechnology	3
Contact the department advising office for course additions.			EN.540.403	Colloids and Nanoparticles	3
200-Level Engineering Courses			EN.540.414	Computational Protein Structure Prediction and Design	3
A maximum of 3 credits from this list may count in focus area			EN.540.421	Project in Design: Pharmacodynamics	3
EN.520.214	Signals and Systems	4	EN.540.422	Introduction to Polymeric Materials	3
EN.520.216	Introduction To VLSI	3	EN.540.432	Project in Design: Pharmacokinetics	3
EN.520.230	Mastering Electronics	3	EN.540.440	Micro/Nanotechnology: The Science and Engineering of Small Structures	3
EN.530.254	Manufacturing Engineering	3	EN.540.465	Engineering Principles of Drug Delivery	3
EN.580.212	Design Team Health-Tech Project II	3	EN.540.602	Metabolic Systems Biotechnology	3
EN.580.298	Advanced Design Team	3	EN.553.391	Dynamical Systems	4
Non Upper-Level Engineering Courses			EN.580.418	Principles of Pulmonary Physiology	3
A maximum of 3 credits from this list may count in focus area			EN.580.430	Systems Pharmacology and Personalized Medicine	4
EN.580.112	Design Team Health-Tech Project II	3	EN.580.432	Principles of Genomic Systems Engineering and Synthetic Biology	3
EN.580.211	Design Team Health-Tech Project I	3	EN.580.435	Applied Bioelectrical Engineering	3
Students may use a maximum of 3 research credits (courses coded EN.XXX.5XX) as a non-upper-level engineering course.			EN.580.441	Cellular Engineering	3
translational cell and tissue Engineering Focus Area			EN.580.442	Tissue Engineering	3
Code	Title	Credits	EN.580.444	Biomedical Applications of Glycoengineering	3
Upper-Level Engineering Courses			EN.580.447	Computational Stem Cell Biology	3
EN.510.311	Structure Of Materials	3	EN.580.452	Cell and Tissue Engineering Lab	3

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 department advising office for course additions.

200-Level Engineering 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	Advanced Design Team	3

Non Upper-Level 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 use a maximum of 3 research credits (courses coded EN.XXX.5XX) as a non-upper-level engineering course.

Sample Program

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.110.202	4	EN.553.311 (or see list of statistics options)	4
EN.553.291	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 Elective	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
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

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**

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.030.106	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
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 Elective	3	BME Focus Area Elective	3
		Humanities/Social Science Elective	3
		Free Elective	3
		15	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	Humanities/Social Science Elective	3
BME Focus Area Elective	3	Free Elective	3
Humanities/Social Science Elective	3		
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
Humanities/Social Science Elective	3		
Humanities/Social Science 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 Focus Area Elective	3 BME Design Sequence (continuation)	3
BME Design Sequence (see list of options)	3 Humanities/Social Science Elective	3
Humanities/Social Science Elective	3	
	15	12

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	Credits	Second Semester	Credits
AS.110.202	4	4 EN.553.311 (or see list of statistics options)	4
EN.500.112, 113, or 114	3	3 EN.580.151	3
EN.553.291	4	4 EN.580.153	1
EN.580.111	2	2 Humanities/Social Science Elective	3
Humanities/Social Science Elective		Humanities/Social Science Elective	3
Free Elective (for waived/no credit Physics Labs)	2	2 Free Elective	3
	15		17

Second Year

First Semester	Credits	Second Semester	Credits
EN.580.221	4	4 EN.580.242	2
EN.580.241	2	2 EN.580.244	2
EN.580.243	2	2 EN.580.246	2
BME Focus Area Elective	3	3 EN.580.248	2
Humanities/Social Science Elective	3	3 BME Focus Area Elective	3
Humanities/Social Science Elective	3	3 Humanities/Social Science Elective	3
		Free Elective	3
	17		17

Third Year

First Semester	Credits	Second Semester	Credits
EN.580.475	2	2 EN.580.4xx Core Elective	3
EN.580.477	1	1 EN.580.4xx Core Elective	3
EN.580.485	2	2 BME Focus Area Elective	3
EN.580.487	1	1 BME Focus Area Elective	3
BME Focus Area Elective	3	3 BME Design Sequence (continuation)	3
BME Focus Area Elective	3	3 Free Elective	3
BME Design Sequence (see list of options)	3		
	15		18

Fourth Year

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

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	4 EN.553.311 (or see list of statistics options)	4
EN.553.291	4	4 EN.580.151	3
EN.500.112, 113, or 114	3	3 EN.580.153	1
EN.580.111	2	2 AS.030.206	4
AS.030.205	4	4 AS.030.225	3
		Humanities/Social Science Elective	3
	17		18

Second Year

First Semester	Credits	Second Semester	Credits
EN.580.221	4	4 EN.580.242	2
EN.580.241	2	2 EN.580.244	2
EN.580.243	2	2 EN.580.246	2
BME Focus Area Elective	3	3 EN.580.248	2
Humanities/Social Science Elective	3	3 BME Focus Area Elective	3
Humanities/Social Science Elective	3	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	2 EN.580.4xx Core Elective	3
EN.580.477	1	1 EN.580.4xx Core Elective	3
EN.580.485	2	2 BME Focus Area Elective	3
EN.580.487	1	1 BME Focus Area Elective	3
BME Focus Area Elective	3	3 BME Focus Area Elective	3
BME Design Sequence (see list of options)	3	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 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).