

The Physician-Engineer (PE) Program

A combined program of Albany Medical College and the Biomedical Engineering Department of Rensselaer Polytechnic Institute

Biomedical Engineering students following the pre-med template are eligible to be considered for admission to the Physician-Engineer Program after the second academic year at Rensselaer.

Application Procedure

1. Submit application materials to the Department of Biomedical Engineering no later than the end of the Spring semester of the second year, *i.e.*, **no later than May 31**. Required materials are:
 - a. Essay on why you want to be a Physician Engineer and how you will use the research component of this program to advance your medical career
 - b. Letter of recommendation
 - c. Official Rensselaer transcript
 - d. Waiver/Release Form allowing the BME Department to obtain your materials from your application for admission to Rensselaer
2. The Biomedical Engineering Department Head will conduct a preliminary review of all applications and forwards applications of candidates with excellent credentials and high likelihood of success in the program to Albany Medical College by **July 1**.
3. The Faculty at Albany Medical College will review forwarded applications and invite students to submit Supplemental Application forms. Students will have **10-14 days** to complete the Supplemental Application and return it, with a \$115 application fee, to Albany Medical College.
4. Selected students will be invited to interview at Albany Medical College in the second half of the summer.
5. Students will be notified of their admission to the Program before the end of the summer.
6. Students admitted to the Program should plan to spend their “away semester” at AMC participating in the Training as Personal Care Assistant program. Furthermore, the required research project for this program will occur during the 8th undergraduate semester, the summer after graduating from RPI and before matriculating at AMC, and the summer between First and Second Years at AMC.

The Physician-Engineer (PE) Program

General Information Sheet

The Physician-Engineer Program is an enriched program leading to the B.S. Biomedical Engineering degree from Rensselaer and the M.D. degree with Distinction in Research from Albany Medical College (AMC). Through this program, both degrees can be obtained within eight calendar years, including some summers. The Physician-Engineer track complements Rensselaer's long standing Physician Scientist track and brings a new type of students to the program: *individuals committed to bring engineering science and technology research to the practice of medicine.*

Approximately half of the Biomedical Engineering students graduating from Rensselaer traditionally either pursue advanced degrees in biomedical research or attend medical school. Many undergraduate Biomedical Engineering students at Rensselaer participate in biomedical research on campus as part of their engineering training.

The curriculum requires a minimum of 133 credit hours to be completed within the first four years (at Rensselaer). Only 128 credits are required for the BS degree in Biomedical Engineering. The remaining 8 credits are needed for the pre-medical requirements and count towards the Research Distinction part of the degree. The Engineering degree is awarded by Rensselaer at the end of the Fourth Year. The MD degree is received at the end of the eighth year and is dependent upon completing all requirements for the BS and MD degrees.

Participation in a research project is a desirable asset to have when applying to this program as research forms an important component even after having earned the BS degree. For students admitted to the Physician Engineer program, the 'required' research project consists of three somewhat distinct time periods but is intended as one continuous project. These time periods are: 8th undergraduate semester (the Transition semester), the summer between undergrad and medical school, and the summer between First and Second Years of medical school

The MCAT requirement is waived for this combined degree program.

The Physician-Engineer (PE) Program

Requirements

Admission to the program is limited to students after their second year of undergraduate study at Rensselaer (Biomedical Engineering) who display the motivation, maturity, and intellectual capacity necessary to pursue this enriched course of study. Rensselaer conducts initial reviews during the Summer Arch and forwards applications of candidates with excellent credentials and high likelihood of success in the program to Albany Medical College for further review. Those applicants with uniformly superior academic credentials and the highest test scores are invited to the required interview at Albany Medical College. Some experience or demonstrated interest in biological or biomedical research during high school and/or freshman year at Rensselaer is considered as a factor in admission. The interview assesses the applicant's motivation for medicine, level of maturity, and level of personal development.

The PE program seeks and admits students without discrimination based on race, religion, color, gender, age, or handicap as defined in the Rehabilitation Act of 1973, or national or ethnic origin. Ordinarily, admission to the program is limited to citizens of the United States.

Provided that the student maintains satisfactory standards of academic achievement, admission leads automatically to entrance into Albany Medical College after four years (eight semesters) of study at Rensselaer. A minimum grade point average of 3.50 (overall GPA and science/math GPA) is required each semester at Rensselaer for promotion to the medical portion of the curriculum. A grade of D or F in any science course generally requires immediate transfer out of this program. Grades of I (Incomplete) are not accepted without justification involving illness or specific course structure. When an Incomplete is granted, the course work must be completed no later than one month after the last day of the examination period of the semester in which the incomplete was received.

Promotion to the medical portion of the curriculum is based on academic achievement and the student's fitness to enter the medical profession.

Since many biomedical engineering students will enter Rensselaer with advanced placement credit, a large proportion will have undergraduate course work credit in excess of standard requirements. These advanced placement credits will allow them to take advanced or additional course work, but cannot be used to decrease the length of time allotted to their undergraduate experience or to decrease the number of courses prescribed in the curriculum. Furthermore, all courses specifically named in the curriculum must be taken at Rensselaer, or given AP credit, or transferred in from courses taken prior to admission at Rensselaer, i.e., no courses can be transferred to the program after the student has started at Rensselaer. After completing the fourth year of the program, students receive a B.S. degree from Rensselaer. The M.D. degree is received at the end of the eighth year

Physician Engineer Program

First Year

Fall		Credit hours	Spring		Credit hours
ENGR 1100	Intro to Engineering Anal	4	ENGR 1300	Engineering Processes	1
CHEM 1100	Chemistry I	4	MATH 1020	Calculus II	4
MATH 1010	Calculus I	4	PHYS 1100	Physics I	4
BIOL 1010	Intro to Biology	3	BIOL 2120	Intro to Cell and Mol Biology	3
BIOL 1015	Intro to Biology Lab	1	BIOL 2125	Intro to Cell and Mol Biology Lab	1
ENGR 1200	Eng Graphics and CAD ⁴	1	CHEM 1200	Chemistry II	4

Second Year

Fall		Credit hours	Spring		Credit hours
BMED 2050	Programming for BME	3	ENGR 2600	Mod. & Analysis of Uncertainty	3
PHYS 1200	Physics II	4	BMED 2100	Biomaterials Science and Eng	4
MATH 2400	Intro to Differential Eq	4	BMED 2540	Biomechanics	4
CHEM 2250	Organic Chem I ⁷	3	BMED 2300	Bioimaging and Bioinstrument	4
CHEM 2230	Organic Chem Lab I	1			
MATH 2010	Multi. Calc and Mat Alg.	4			

The Arch: Summer Here

BMED 4200	Modeling of Biomed Sys	3
CHEM 2260	Organic Chem II	3
CHEM 2240	Organic Chem Lab II	1
BCBP 4760	Molecular Biochemistry I	4
STSS 2520	Sociology	4

Third Year

Fall		Credit hours	Spring		Credit hours
Personal Care Assistant Training at AMC or equivalent patient contact			BMED 4500	Advanced Systems Physiology	4
			BMED 4250	Biomedical Transport Phenomena	4
			PSYC 1200	General Psychology	4
			ENGR 2050	Intro to Eng Design	4
			ENGR 4010	Prof. Development: Leadership ¹	1

Fourth Year

Fall		Credit hours	Spring		Credit hours
BMED 4010	Bioeng Lab ²	4	BMED 4600	BME Design ³	3
BMED 4260	BME Prod. Dev & Com	3	BMED 4120	Investigative Medicine II ⁶	1
BMED 4110	Investigative Medicine I ⁶	1	BMED 4130	Biomedical Research ⁶	4
	BME Tech Elective	3		HASS Elective ⁵	4
	HASS Elective ⁵	4		HASS Elective ⁵	4
STSS 4100	Profess. Dev: Tech Issues ¹	2			

The minimum number of credit hours for the degree is 133

BS in Biomedical Engineering is awarded at Rensselaer

¹ For a list of courses that satisfy the Professional Development – Technical Issues & Solutions requirement, refer to the link “Professional Development Courses” on the Registrar’s “Academic Planning” web page. It should be completed before the capstone design course.

² BMED 4010 may be taken in either Spring Year 3 or Fall Year 4.

³ Capstone writing-intensive course.

⁴ ENGR 1400 may be taken as alternative to ENGR 1200. This course may be taken either semester.

⁵ Two of the HASS courses need to be COMM, LITR, or WRIT to satisfy the English requirement

⁶ These three classes are taught at AMC and are only open to students in the Physician Engineer or Physician Scientist programs. The classes replace BME Tech Electives III & IV.

⁷ Organic Chemistry I counts as BME Tech Elective I

Summer after Fourth Year

Research at AMC or Rensselaer

Fifth Academic Year**

Subjects: Anatomy, Histology, Embryology, Biochemistry, Physiology, Radiology, OB/GyN, Pediatrics, Medicine, Neurology, Psychiatry, Surgery, Epidemiology, Social Sciences, and Library.

Summer after Fifth Year**

Research at AMC or Rensselaer

Completion of Research Thesis for the Distinction in Research (MDDR) degree requirement.

Sixth Academic Year

Subjects: Pathology, Pharmacology, Immunology, Medicine, OB/GyN, Neurology, Pediatrics, Radiology, Radiation Oncology, PM&R, Psychiatry, Epidemiology, Social Sciences, and Library.

Summer after Sixth Year

2nd Year Medical School Exams (First Medical Board Exam) USMLE Step I

Seventh Academic Year

Required Ambulatory based Clerkships (Medicine, Family Practice, Pediatrics, Psychiatry, OB/GyN, Surgery).

Summer after Seventh Year

USMLE Step II Clinical Knowledge; USMLE Step II Clinical Skills

Eighth Academic Year

Required Hospital based Clerkships.

MD is awarded at AMC

**** See next page for details on how subject-based curriculum in 5th and 6th years is now woven into a system/theme-based curriculum.**

Year 5 Theme Schedule

Medical Cell Biology and Genetics

Musculoskeletal System I

Nervous System I

Cardiovascular System I

Renal/Respiratory Systems I

Gastrointestinal System I

Endocrine, Reproductive Systems and Integrative Metabolism

Immunology and Microbiology

Year 6 Theme Schedule

Principles of Drug Therapy

Introduction to Pathology

Disease and Defense

Introduction to Oncology

Lymphohematopoietic Systems

Nervous Systems II

Behavioral Science

Gastrointestinal Systems II

Respiratory Systems II

Renal and Urinary Systems II

Endocrinology

Cardiovascular Systems II

Musculoskeletal Systems II

Reproductive Systems

Defense of Thesis

BME Bachelor's Degree Requirements

HASS Core Program: School of Engineering Requirements

Undergraduate students must have an area of focus in their HASS studies that is accomplished by completing an approved 12-credit depth concentration, known as the HASS Integrative Pathways. Some students will satisfy a modified version of this requirement.

The HASS Integrative Pathways were created to enhance students' HASS Core curriculum by bringing intentionality and depth to the requirements. The themes of the pathways vary in their intentionality; some are interdisciplinary, while others focus on a single discipline, providing students with significant options for their coursework. In addition to providing a more in-depth focus to the HASS Core, many Integrative Pathways can be transformed into minors with relative ease.

The complete list of pathway titles, descriptions, and associated courses can be found <https://info.rpi.edu/hass-pathways/pathways-topics>. Information about compatible minors can also be found on this page.

Core BME Courses (and recommended semesters for taking them)

All of these courses are required for a BME degree and they need to be taken for a letter grade. No substitutions with other courses offered at Rensselaer are allowed.

BMED 2050	Programming for BME	(3CR) (F2, S2)
BMED 2100	Biomaterials Science and Engineering	(4CR) (S2)
BMED 2540	Biomechanics	(4CR) (S2)
BMED 2300	Bioimaging and Bioinstrumentation	(4CR) (S2)
BMED 4200	Modeling of Biomedical Systems	(3CR) (F3, S3, or Summer of The Arch)
BMED 4250	Biomedical Transport Phenomena	(4CR) (F3, S3, or Summer of The Arch)
BMED 4010	BME Lab	(4CR) (S3, F4, or Summer of The Arch)
BMED 4500	Advanced Systems Physiology	(4CR) (S3)
BMED 4260	BME Product Devel. & Commercialization	(3CR) (F4)
BMED 4600	BME Design	(3CR) (S4)

BME Technical Electives

Four courses need to be taken to satisfy the BME Technical Elective requirement. These courses need to be 3 or 4 credit hour courses and they have to be taken for a letter grade. The BME Technical Elective courses can be chosen from the list found in the undergraduate handbook or they can be any formal 4000-level BMED course, i.e., no "Studies in BME", "Topics in BME" or research courses.

That being said, Organic Chemistry I counts as one of the technical electives. Investigative Medicine I & II and Biomedical Research replace another two electives for students in the Physician Engineer program. So there is only one BME Technical Elective, usually taken in their 7th semester, that students in the Physician Engineer program need to take.

Prerequisite Chart

Course

Pre requisite

Biology, Chemistry, Math, Physics:

BIOL 2120	Introduction to Cell and Molecular Biology	None
BIOL 2125	Introduction to Cell and Molecular Bio. Lab	None
CHEM 1100	Chemistry I	None
MATH 1010	Calculus I	None
MATH 1020	Calculus II	MATH 1010
MATH 2010	Multivariable Calculus and Matrix Algebra	MATH 1020
MATH 2400	Differential Equations	MATH 1020
PHYS 1100	Physics I	None
PHYS 1200	Physics II	PHYS 1100, co-req MATH 1020

Engineering Core Courses:

CSCI 1190	Beginning Programming for Engineers	None
ENGR 1100	Intro to Engineering Analysis	None
ENGR 1200	Engineering Graphics and CAD	None
ENGR 1300	Engineering Processes	None
ENGR 2050	Intro to Engineering Design	ENGR 1100 and either ENGR 1200 or ENGR 1400, co-req PHYS 1200
ENGR 2600	Modeling and Analysis of Uncertainty	MATH 1010
ENGR 4010	Professional Development: Leadership	None
STSS 4100	Professional Development: Tech Issues	None

BME Core:

BMED 2050	Programming for BME	ENGR 1100
BMED 2100	Biomaterials Science and Engineering	None
BMED 2300	Bioimaging and Bioinstrumentation	PHYS 1200
BMED 2540	Biomechanics	ENGR 1100
BMED 4010	BME Lab	BMED 2100, BMED 2300, BMED 2540
BMED 4200	Modeling of Biomedical Systems	MATH 2400, PHYS 1200, BMED 2050
BMED 4250	Biomedical Transport Phenomena	ENGR 1100, PHYS 1100, MATH 2400
BMED 4260	BME Product Devel. & Commercialization	ENGR 2050, Senior standing
BMED 4500	Advanced Systems Physiology	BIOL 2120
BMED 4600	BME Design	BMED 4260

BME Technical Elective Courses:

BMED 4410	BioMEMS	Junior or Senior standing
BMED 4440	Biophotonics	PHYS 1200
BMED 4450	Drug and Gene Delivery	BMED 2100
BMED 4460	Biological Image Analysis	BMED 2300
BMED 4470	Biostatistics for Life Science Applications	MATH 2010 and ENGR 2600
BMED 4480	Biomedical Data Science	MATH 2010 and ENGR 2600
BMED 4510	Mechanobiology	BMED 2540
BMED 4540	Biomechanics II	BMED 2540 or ENGR 2530
BMED 4550	Cell Biomechanics	BMED 2540 or ENGR 2530
BMED 4580	Biomedical Fluid Mechanics	BMED 4250 or ENGR 2250
BMED 4590	Medical Imaging	BMED 2300 or approval of instructor
BMED 4650	Intro to Cell and Tissue Engineering	BMED 4250 or ENGR 2250 and either BMED 2540 or ENGR 2530
BMED 4660	Muscle Mechanics and Modeling	None
ECSE 2010	Electric Circuits	MATH 2400, PHYS 1200
ECSE 2410	Signals and Systems	ECSE 2010
ECSE 4090	Mechatronics	ENGR 2350, ECSE 2410, and Senior standing

ECSE 4480	Robotics I	MATH 2400 and either MATH 2010 or ENGR 1100
ENGR 2300	Electronic Instrumentation	PHYS 1200, co-req MATH 2400.
ENGR 2350	Embedded Control	CSCI 1010 or CSCI 1100 or CSCI 1190
MANE 4030	Elements of Mechanical Design	MATH 2400, ENGR 2530
MANE 4050	Modeling and Control of Dynamic Systems	MATH 2400, PHYS 1200
MANE 4240	Introduction to Finite Elements	ENGR 2250 or ENGR 2530 or ECSE 4160
MANE 4670	Mechanical Behavior of Materials	ENGR 2530
MANE 6480	Health Phys, & Med. Aspects of Radiation	None
MTLE 2100	Structure of Engineering Materials	ENGR 1600 or equivalent (BMED 2100)
MTLE 4050	Introduction to Polymers	None
MTLE 4250	Mechanical Properties of Materials	ENGR 1600, MTLE 2100
MTLE 4470	Biology in Materials Science	ENGR 1600
MTLE 4720	Applied Math. Methods in Materials	MATH 2400, and access to Mathematica

Premed Courses (pre-requisites adjusted to satisfy premed requirements):

BIOL 1010	Introduction to Biology	Co-req BIOL 1015
BIOL 1015	Introduction to Biology Lab	Needs to be taken with BIOL 1010
CHEM 2250	Organic Chemistry I	CHEM 1100, co-req CHEM 2230
CHEM 2230	Organic Chemistry Lab I	Needs to be taken with CHEM 2250
CHEM 2260	Organic Chemistry II	CHEM 2250, co-req CHEM 2240
CHEM 2240	Organic Chemistry Lab II	Needs to be taken with CHEM 2260
BCBP 4760	Molecular Biochemistry I	CHEM 2250 and either BIOL 1010 or BIOL 2120
PSYC 1200	General Psychology	None
STSS 1520	Sociology	None
BMED 4110	Investigative Medicine I	Physician Engineer status
BMED 4120	Investigative Medicine II	Physician Engineer status, BMED 4110
BMED 4130	Biomedical Research	Physician Engineer status