The Charles V. Schaefer, Jr. School of Engineering

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Bachelor of Engineering

The Degree of Bachelor of Engineering (BE) is offered in the following nine programs. The areas of focus can be achieved by selecting appropriate elective courses.

Biomedical Engineering Program

Chemical Engineering Program*
- Areas of Focus: Chemical Engineering
  - Biochemical Engineering
  - Materials Engineering

Civil Engineering Program*
- Areas of Focus: Construction Management
  - Water Resources Engineering
  - Structural Engineering
  - Environmental Engineering
  - Ocean Engineering
  - Geotechnical Engineering

Computer Engineering Program*
- Areas of Focus: Computer Systems and Architectures
  - Data Networks and Information Systems
  - Software/Software Engineering
  - Digital Systems

Electrical Engineering Program*
- Areas of Focus: Telecommunications
  - Data Networks
  - Signal Processing
  - Electronic Circuits

Engineering Program* (Concentration in Biomedical Engineering)

Engineering Management Program*
- Areas of Focus: Systems Engineering

Environmental Engineering Program*
- Areas of Focus: Groundwater Pollution
  - Environmental Hydrodynamics
  - Biological and Physicochemical Processes

Mechanical Engineering Program*
- Areas of Focus: Design and Manufacturing
  - Energy Systems
  - Machine Systems
  - Robotics

* Note: The asterisk indicates programs which are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012- tel (410) 347-7700

Minors
Biochemical Engineering
Chemical Engineering
Coastal Engineering
Computer Engineering
Electrical Engineering
Engineering Management
Environmental Engineering
Structural Engineering
Water Resources

Master of Engineering
Chemical Engineering
- Chemical Engineering
- Polymer Engineering

Civil Engineering
- Geotechnical/Geoenvironmental Engineering
- Structural Engineering
- Water Resources Engineering
- Construction Management (Interdisciplinary)

Computer Engineering
- Computer Systems
- Data Communications and Networks
- Digital Systems Design
- Image Processing and Multimedia
- Software Engineering

Electrical Engineering
- Computer Architecture and Digital System Design
- Microelectronics and Photonics Science and Technology (Interdisciplinary)
- Signal Processing for Communications
- Telecommunications Engineering

Engineering Management
Environmental Engineering
- Environmental Process
- Groundwater and Soil Pollution Control
- Inland and Coastal Environmental Hydrodynamics

Integrated Product Development
- Armament Engineering
- Electrical and Computer Engineering
- Manufacturing Technologies
- Systems Reliability and Design

Materials Engineering
- Microelectronics and Photonics Science and Technology (Interdisciplinary)

Mechanical Engineering
- Manufacturing Systems

Networked Information Systems
- Data Communication Networks

- Information Networks
- Multimedia Information Systems
- Multimedia Technologies
- Network Systems Technologies
- Networked Information Systems
- Networked Information Systems: Business Practices
- Secure Network Systems

Ocean Engineering
- Coastal Engineering
- Hydrodynamics
- Naval Architecture
- Oceanography

Systems Engineering
- Systems Design and Operational Effectiveness

Master of Science

Construction Management (Interdisciplinary)

Maritime Systems
- Environmental Engineering
- Structural Engineering
- Management
- Marine Transportation

Engineer

Chemical Engineer
Civil Engineer
Computer Engineer
Electrical Engineer
Mechanical Engineer

Doctor of Philosophy

Chemical Engineering
Civil Engineering
Computer Engineering
Electrical Engineering
Engineering Management
Environmental Engineering
Materials Engineering
Mechanical Engineering
Ocean Engineering
Systems Engineering

BACHELOR OF ENGINEERING

The Stevens engineering curriculum is rooted in a tradition that has set it apart since the founding of the Institute in 1870, yet it remains responsive to the changing demands of the workplace into which you graduate. The Stevens tradition recognizes the value of a broad core curriculum that provides significant breadth in engineering, the sciences and the humanities, combined with the necessary depth in your chosen

engineering discipline.

To meet these goals, the Charles V. Schaefer, Jr. School of Engineering offers a demanding curriculum. It prepares you technically and instills a work ethic that has proven of considerable value to our graduates throughout their lives. In addition to strong technical competencies in general engineering and the specific discipline, the curriculum teaches key competencies that are highly valued by employers. These include strong problem-solving skills, effective team-participation skills and the ability to communicate effectively, in both written and oral modes.

A major vehicle for achieving these competencies in the engineering curriculum is the Design Spine. Design Spine is a sequence of design courses each semester; initially it is integrated with science and engineering core courses and, in future semesters, the discipline-specific program. Design is at the heart of engineering. Design activities allow you to gain confidence in applying and reinforcing the knowledge learned in the classroom.

As an engineering student, you take core courses for the first three semesters. The choice of the engineering discipline in which you will concentrate is made late in the third semester. You are provided many opportunities to explore the various engineering fields.

You may choose to specialize in biomedical, chemical, civil, computer, electrical, environmental or mechanical engineering, as well as engineering management. A program in engineering is also available which presently has a conentration in biomedical engineering.

A strength of the Stevens engineering curriculum is the requirement of a humanities course in each of the eight semesters of the program. You may take advantage of this as a platform when opting to add a humanities minor by taking several extra courses, or to pursue the double degree program, a B.A. degree in addition to the B.E. degree.

The following pages outline the structure of the engineering curriculum by semester, showing core course and technical elective requirements. Specific concentrations are described by the department, as are requirements for their minor programs.

Mission and Objectives

The Charles V. Schaefer, Jr. School of Engineering is dedicated to educating students to have the breadth and depth required to lead in their chosen profession in an environment replete with the excitement of new knowledge and technology creation.

The graduates of the Charles V. Schaefer, Jr. School of Engineering shall:

- Demonstrate technical competence in engineering design and analysis consistent with the practice of a specialist and with the broad perspective of the generalist.
- Develop the hallmarks of professional conduct, including a keen cognizance of ethical choices, together with the confidence and skills to lead, to follow, and to transmit ideas effectively.
- Inculcate learning as a lifelong activity and as a means to the creative discovery, development, and implementation of technology.

Our graduate programs prepare students to:

- expand the scope of their professional activities in academia, industry and government, and increase the diversity of their careers; and
- create and transfer knowledge through cutting-edge research, and succeed in bringing innovations to the marketplace.

Course Sequence

The general template of the engineering curriculum for all programs is as follows:

ENGINEERING CURRICULUM

Freshman Year

Term I					Term II				
		Hrs. Per Wk. Class	Lab	Sem. Cred.			Hrs. Per Wk. Class	Lab	Sem. Cred.
Ch 107	General Chemistry IA	2	0	2	Ch 116	General Chemistry II	3	0	3
Ch 117	General Chemistry Lab I	0	3	1	Ch 118	General Chemistry Lab II	0	3	1
Ma 115	Math Analysis I	3	0	3	Ma 116	Math Analysis II	3	0	3
PEP101	Physics I	3	0	3	PEP102	Physics II	3	0	3
E 121	Engineering Design I	0	3	2	E 122	Engineering Design II	0	3	2
E 120	Engineering Graphics	0	2	1	E 126	Mechanics of Solids	4	0	4
E 115	Intro. to Programming	1	1.5	2	Hu	Humanities	3	0	3
Hu	Humanities	3	0	3	PE 200	Phys Ed. II	0	2	1
PE 200	Phys. Ed. I	0	2	1					
	TOTAL	**12**	**11.5**	**18**		**TOTAL**	**16**	**8**	**20**

Sophomore Year

Term III					Term IV				
		Hrs. Per Wk. Class	Lab	Sem. Cred.			Hrs. Per Wk. Class	Lab	Sem. Cred.
Ma 221	Differential Equations	4	0	4	Ma 227	Multivariate Calculus	3	0	3
PEP201	Physics III	2	0	2	E 246	Electronics & Instrument	3	0	3
PEP211	Physics Labfor Engin.	0	3	1	E 232	Engineering Design IV	0	3	2
E 234	Intro to Thermo	3	0	3	E243	Prob. & Stat **or**	3	0	3
E 245	Circuits & Systems	2	3	3	T.E.	Technical Elective[1]			
E 231	Engineering Design III	0	3	2	T.E	Technical Elective[1]	4	0	4
Hu	Humanities	3	0	3	Hu	Humanities	3	0	3
PE 200	Phys. Ed. III	0	2	1	PE 200	Phys Ed. IV	0	2	1
	TOTAL	**14**	**11**	**19**		**TOTAL**	**16**	**5**	**19**

Junior Year

Term V					Term VI				
		Hrs. Per Wk. Class	Lab	Sem. Cred.			Hrs. Per Wk. Class	Lab	Sem. Cred.
E 342	Transport /Fluid Mech.[1]	3	3	4	E 345	Modeling & Simulation[1]	3	0	3
E 344	Materials Processing	3	0	3	E 355	Engineering Economics	3	3	4
E 321	Engineering Design V	0	3	2	E 322	Engineering Design VI[1]	1	3	2
E 243 or	Prob. & Stat **or**	3	0	3	T.E	Technical Elective[1]	3	0	3
T.E.	Technical Elective[1]				T.E	Technical Elective[1]	3	0	3
T.E	Technical Elective[1]	3	0	3	Hu	Humanities	3	0	3
Hu	Humanities	3	0	3	PE 200	Phys Ed VI	0	2	1
PE 200	Phys Ed V	0	2	1					
	TOTAL	**15**	**8**	**19**		**TOTAL**	**16**	**8**	**19**

Senior Year

Term VII					Term VIII				
		Hrs. Per Wk. Class	Lab	Sem. Cred.			Hrs. Per Wk. Class	Lab	Sem. Cred.
T.E	Technical Elective[1]	3	0	3	T.E	Technical Elective[1]	3	0	3
T.E	Technical Elective[1]	3	0	3	T.E	Technical Elective[1]	3	0	3
E	Elective	3	0	3	E	Elective	3	0	3
E 423	Engineering Design VII[1]	0	8	3	E 424	Engineering Design VII[1]	0	8	3
E 421	Engineering Econ. Design	1	3	2	Hu	Humanities	3	0	3
Hu	Humanities	3	0	3					
	TOTAL	**13**	**11**	**17**		**TOTAL**	**12**	**8**	**15**

[1] Discipline specific course

All students must satisfy an English Language proficiency requirement.

ENGINEERING PROGRAM

In addition to ofering accredited B.E. degree programs in specific engneering disciplines, Stevens also offers an accredited B.E. degree program in Engineering. The B.E. in Engineering is founded on the strength of the extensive Stevens core corriculum in exposing students to a breadth of engineering topics while allowing for concentration in an engineering area. In this regard it allows for a somewhat more flexible program than is typically available in a specialized B.E. program. At present a concentration in Biomedical Engineering is offered under the Engineering program.* Several technical eletives within the program can be tailored to a student's interests under the guidance of the program faculty adviso.

*Note: this program differs from the recently instituted specialized B.E. program in biomedical engineering. The latter is not yet eligible for accreditation.

Course Sequence

A typical course sequence for Engineering with a concentration in biomedical engineering is as follows:

Freshman Year

Term I					Term II				
		Hrs. Per Wk. Class	Lab	Sem. Cred.			Hrs. Per Wk. Class	Lab	Sem. Cred.
Ch 107	General Chemistry IA	2	0	2	Ch 116	General Chemistry II	3	0	3
Ch 117	General Chemistry Lab I	0	3	1	Ch 118	General Chemistry Lab II	0	3	1
Ma 115	Math Analysis I	3	0	3	Ma 116	Math Analysis II	3	0	3
PEP 101	Physics I	3	0	3	PEP 102	Physics II	3	0	3
E 121	Engineering Design I	0	3	2	E 122	Engineering Design II	0	3	2
E 120	Engineering Graphics	0	2	1	E 126	Mechanics of Solids	4	0	4
E 115	Intro to Programming	1	1.5	2	Hu	Humanities	3	0	3
Hu	Humanities	3	0	3	PE 200	Physical Education II	0	2	1
PE 200	Physical Education	0	2	1					
	TOTAL	**12**	**11.5**	**18**		**TOTAl**	**16**	**8**	**20**

Sophomore Year

Term III					Term IV				
		Hrs. Per Wk. Class	Lab	Sem. Cred.			Hrs. Per Wk. Class	Lab	Sem. Cred.
Ma 221	Math Analysis III	4	0	4	Ma 227	Math Analysis IV	3	0	3
PEP 201	Physics III	2	0	2	E 246	Electronics and Instrumentat	3	0	3
PEP 211	Physics Lab for Engin.	0	3	1	E 232	Engineering Design IV	0	3	2
E 234	Intro to Thermo.	3	0	3	Ch 281	Biology and Biotechnology	3	0	3
E 245	Circuits and Systems	2	3	3	Ch 282	Intro Biology Lab	0	3	1
E 231	Engineering Design III	0	3	2	BME 306	Intro to BME	3	0	3
Hu	Humanities	3	0	3	Hu	Humanities	3	0	3
PE 200	Physical Education III	0	2	1	PE 200	Physical Education IV	0	2	1
	TOTAL	**14**	**11**	**19**		**TOTAL**	**15**	**8**	**19**

Junior Year

Term V					Term VI				
		Hrs. Per Wk. Class	Lab	Sem. Cred.			Hrs. Per Wk. Class	Lab	Sem. Cred.
BME 342	Transport in Bio. Sys.	3	3	4	TE	Technical Elective	3	0	3
E344	Materials Processing	3	0	3	TE	Technical Elective	3	0	3
E 321	Engineering Design V	0	3	2	E 355	Engineering Economics	3	3	4
Ch 381	Cell Biology	3	3	4	BME 322	Engineering Design VI	1	3	2
Ch 241	Organic Chemistry I	3	4	4	Ch 242	Organic Chemistry II	3	4	4
Hu	Humanities	3	0	3	Hu	Humanities	3	0	3
PE 200	Physical Education V	0	2	1	PE 200	Physical Education VI	0	2	1
	TOTAL	**15**	**15**	**21**		**TOTAL**	**16**	**12**	**20**

Senior Year

Term VII					Term VIII				
		Hrs. Per Wk. Class	Lab	Sem. Cred.			Hrs. Per Wk. Class	Lab	Sem. Cred.
BME 482	Engineering Physiology	3	3	4	BME 445	Biosystems Sim. & Con	3	3	4
EL	Elective	3	0	3	EL	Elective	3	0	3
E 243	Probability and Statistics	3	0	3	TE	Technical Elective	3	0	3
BME 423	Engineering Design VII	0	8	3	BME 424	Engineering Design VIII	0	8	3
E 421	Engineering Econ Design	1	3	2	Hu	Humanities	3	0	3
Hu	Humanities	3	0	3					
						TOTAL	**12**	**11**	**16**
	TOTAL	**13**	**14**	**18**					

DOUBLE DEGREE PROGRAM

You may elect to pursue a B.E. degree concurrently with a B.S. degree, or a second B.E. degree. You must satisfy all of the requirements for both degrees (including two Senior Design sequences for the case of two B.E. degrees), and to have completed at least 24 credits beyond the higher of the two program requirements. Two Study Plans are required if you elect this option.

Core Curriculum

Undergraduate Engineering

E 115 Introduction to Programming for Engineers
(1-1.5-2)
An introduction to the use of an advanced programming language for use in engineering applications, using C++ as the basic programming language and MS Visual C++ as the program development environment. Topics covered include basic syntax (data types and structures, input/output instructions, arithmetic instructions, loop constructs, functions, subroutines, etc) needed to solve basic engineering problems as well as an introduction to advanced topics (use of files, principles of objects and classes, libraries, etc.). Algorithmic thinking for development of computational programs and control programs from mathematical and other representations of the problems will be developed. Basic concepts of computer architectures impacting the understanding of a high-level programming language will be covered. Basic concepts of a microcontroller architecture impacting the use of a high-level programming language for development of microcontroller software will be covered, drawing specifically on the microcontroller used in E121 (Engineering Design I). Corequisite: E121.

E 120 Engineering Graphics
(0-2-1)
Engineering graphics: principles of orthographic and auxiliary projections, pictorial presentation of engineering designs, dimensioning and tolerance, sectional and detail views, assembly drawings. Descriptive geometry. Engineering figures and graphs. Solid modeling introduction to computer-aided design and manufacturing (CAD/CAM) using numerically-controlled (NC) machines.

E 121 Engineering Design I
(0-3-2)
This course introduces students to the process of design and seeks to engage their enthusiasm for engineering from the beginning of the program. The engineering method is used in the design and manufacture of a product. Product dissection is exploited to evaluate how others have solved design problems. Development is started on competencies in professional practice topics, primarily: effective group participation, project management, cost estimation, communication skills and ethics. Engineering Design I is linked to and taught concurrently with the Engineering Graphics course. Engineering graphics are used in the design projects and the theme of "fit to form" is developed. Corequisite: E 115, E 120.

E 122 Engineering Design II
(0-3-2)
This course continues the freshman year experience in design. Design projects are linked to the Mechanics of Solids course (integrated Statics and Strength of Materials) taught concurrently. The engineering method introduced in Engineering Design I is reinforced. Further introduction of professional practice topics are linked to their application and testing in case studies and project work. Basic concepts of design for environment and aesthetics are introduced. Prerequisite: E 121. Corequisite: E 126.

E 126 Mechanics of Solids
(4-0-4)
Fundamental concepts of particle statics, equivalent force systems, equilibrium of rigid bodies, analysis of trusses and frames,

forces in beam and machine parts, stress and strain, tension, shear and bending moment, flexure, combined loading, energy methods, statically indeterminate structures. Prerequisites: PEP 101 or PEP 111, Ma 115.

E 231 Engineering Design III
(0-3-2)
This course continues the experiential sequence in design. Design projects are linked with Thermodynamics and Circuits and Systems courses taught concurrently. Core design themes are further developed. Prerequisite: E 122. Corequisites: E 234 andE 245.

E 232 Engineering Design IV
(0-3-2)
This course continues the experiential sequence in design. Design projects are linked with the Electronics and Instrumentation course taught concurrently. Core design themes are further developed. Prerequisite: E 231. Corequisite: E 246.

E 234 Introduction to Thermodynamics
(3-0-3)
Concepts of heat and work, First and Second Laws for closed and open systems including steady processes and cycles, thermodynamic properties of substances and interrelationships, phase change and phase equilibrium, chemical reactions and chemical equilibrium, representative applications. Prerequisites: PEP 101 or PEP 111, Ch 107 or Ch 115, Ma 115.

E 243 Probability and Statistics for Engineers
(3-0-3)
Descriptive statistics, pictorial and tabular methods, measures of location and of variability, sample space and events, probability and independence, Bayes formula, discrete random variables, densities and moments, normal, gamma, exponential and Weibull distributions, distribution of the sum and average of random samples, the central limit theorem, confidence intervals for the mean and the variance, hypothesis testing and p-values, applications for prediction in a regression model. A statistical computer package is used throughout the course for teaching and for project assignments. Prerequisite: Ma 116.

E 245 Circuits and Systems
(2-3-3)
Ideal circuit elements; Kirchoff laws and nodal analysis; source transformations; Thevenin/Norton theorems; operational amplifiers; response of RL, RC and RLC circuits; sinusoidal sources and steady state analysis; analysis in frequently domain; average and RMS power; linear and ideal transformers; linear models for transistors and diodes; analysis in the s-domain; Laplace transforms; transfer functions. Prerequisite: PEP 102 or PEP 112. Corequisite: Ma 221.

E 246 Electronics and Instrumentation
(3-0-3)
Signal acquisition procedures; instrumentation components; electronic amplifiers; signal conditioning; low-pass, high-pass and band-pass filters; A/D converters and anti-aliasing filters; embedded control and instrumentation; micro-controllers; digital and analog I/O; instruments for measuring physical quantities such as motion, force, torque, temperature, pressure, etc.; FFT and elements of modern spectral analysis; random signals; standard deviation and bias. Prerequisite: E 245.

E 321 Engineering Design V
(0-3-2)
This course includes both experimentation and open-ended design problems that are integrated with the Materials Processing course taught concurrently. Core design themes are further developed. Corequisite: E 344.

E 322 Engineering Design VI [discipline specific]
(1-3-2)
This course allows each discipline to address design topics specific to their discipline. The latter part of this course is structured to allow for project selection, team formation and preparation of a proposal suitable for submission to a potential sponsor for the senior design capstone project. Core design themes are further developed. Prerequisite: E 321. Co-requisites: E 345 (discipline specific) and E 355.

E 342 Transport/Fluid Mechanics [discipline specific] (3-3-4)
Offered as a specific departmental course; e.g., see ME departmental listing.

E 344 Materials Processing (3-0-3)
An introduction is provided to the important engineering properties of materials, to the scientific understanding of those properties and to the methods of controlling them. This is provided in the context of the processing of materials to produce products. Prerequisite: Ch 116 and Ch 118.

E 345 Modeling and Simulation [discipline specific] (3-0-3)
Development of deterministic and non-deterministic models for physical systems, engineering applications, simulation tools for deterministic and non-deterministic systems, case studies and projects.

E 355 Engineering Economics (3-3-4)
Basics of cost accounting and cost estimation, cost-estimating techniques for engineering projects, quantitative techniques for forecasting costs, cost of quality. Basic engineering economics, including capital investment in tangible and intangible assets. Engineering project management techniques, including budget development, sensitivity analysis, risk and uncertainty analysis and total quality management concepts. Prerequisites: E 121, E 122, E 231 and E 232.

E 400 Research in Engineering (up to 6 credits total)
Individual research investigation under the guidance of a faculty advisor. Hours/credits to be arranged. A final report/thesis and a formal presentation in a seminar/conference is required. Prerequisite: Senior standing.

E 421 Engineering Economic Design (1-3-2)
This course continues the engineering economic analysis and professional practice thread. This course is linked to the senior capstone design courses and provides for the development of economic analysis and project management, among others. Issues related to the marketing of products are addressed. Prerequisites: E 355 and E 321.

E 423-424 Engineering Design VII-VIII [discipline specific] (0-8-3) (0-8-3)
Senior design capstone courses include a capstone project spanning two semesters. While the focus is on the capstone disciplinary design experience, all programs include the two-credit core module on Engineering Economic Design (E 421) during the first semester. Prerequisite: Senior standing.