

The Arthur E. Imperatore School of Sciences and Arts

Interdisciplinary Programs: Program in Computational Science

Supervisory Committee

Elli Angelopoulou, Computer Science
Kurt Becker, Physics
Michael Bruno, Ocean Engineering
Wayne Carr, Physics
Quynh Dinh, Computer Science
Robert Gilman, Mathematics
Sophia Hassiotis, Civil Engineering
George Kamberov, Computer Science
Khalidoun Khashanah, Mathematics
Yi Li, Mathematics
Marc Mansfield, Chemistry
Patrick Miller, Mathematics
Nicolai Panikov, Chemical Biology
Roger Pinkham, Mathematics
David Vaccari, Environmental Engineering
Susanne Wetzels, Computer Science
Rebecca Wright, Computer Science

UNDERGRADUATE PROGRAMS

Computational Science is an emerging field in which sophisticated computational techniques are used to build models and solve problems related to science and engineering. It complements existing theoretical and experimental approaches and may be thought of as a new mode of scientific inquiry.

At Stevens, undergraduates may study computational science through an interdisciplinary program leading to a bachelor of science in computational science with a specialization in an area of science or engineering. The current specializations are:

- Computational Biology
- Computational Chemistry
- Computational Mechanics
- Computational Oceanography
- Computational Physics
- Computer Vision
- Cybersecurity
- Environmental Systems

The program consists of the science curriculum core courses and technical electives. The technical electives are divided between foundation courses in mathematics and computer science, and application courses in the student's area of specialization. An important part of the program is a project or research problem to be done in the senior year. Each student must choose one of the application areas listed above prior to preparing their study plan. Each student's study plan reflects his or her interests and aspirations, and is made up by the student, working with a member of the Supervisory Committee. Potential students are encouraged to consult members of this committee for further information.

The following table includes the core courses and typical foundation courses. Application area courses are discussed below. Courses need not be taken in exactly the order listed.

Freshman Year**Term I**

		Hrs. Per Wk.		Sem. Cred.
		Class	Lab	
Ma 115	Math Analysis I	3	0	3
Ch 115	General Chemistry I	3	0	3
Ch 117	General Chemistry Lab I	0	3	1
CS 105	Intro to Scientific Computing	2	2	3
OR				
CS 115	Intro to Computer Science	3	2	4
PEP 111	Mechanics	3	0	3
Hu	Humanities	3	0	3
PE 200	Physical Education I	0	2	1
TOTAL		14(15)	7	17(18)

Term II

		Hrs. Per Wk.		Sem. Cred
		Class	Lab	
Ma 116	Math Analysis II	3	0	3
Ch 116	General Chemistry II	3	0	3
Ch 118	General Chemistry Lab II	0	3	1
Ch 281	Biology and Biotechnology	3	0	3
PEP 112	Electricity and Magnetism	3	0	3
Hu	Humanities	3	0	3
PE 200	Physical Education II	0	2	1
TOTAL		15	5	17

Sophomore Year**Term III**

		Hrs. Per Wk.		Sem. Cred.
		Class	Lab	
Ma 221	Differential Equations	4	0	4
Ma 334	Discrete Mathematics	3	0	3
Mgt	Economics	3	0	3
PEP 221	Physics Lab I	0	3	1
Hu	Humanities	3	0	3
PE 200	Physical Education III	0	2	1
TOTAL		13	5	15

Term IV

		Hrs. Per Wk.		Sem. Cred
		Class	Lab	
Ma 227	Multivariate Calculus	3	0	3
	Thermodynamics	3	0	3
CS 284	Data Structures & Alg. I	3	0	3
PEP 222	Physics Lab II	0	3	1
Hu	Humanities	3	0	3
PE 200	Physical Education IV	0	2	1
TOTAL		12	5	14

**Junior Year
Term V**

		Hrs. Per Wk.		
		Class	Lab	Sem. Cred.
Ma 232	Linear Algebra	3	0	3
Ma 346	Numerical Methods	3	0	3
CS 385	Data Structures & Alg. II	3	0	3
TE	Technical Elective	3	0(3)	3(4)
Hu	Humanities	3	0	3
PE 200	Physical Education V	0	2	1
TOTAL		15	2(5)	16(17)

Term VI

		Hrs. Per Wk.		
		Class	Lab	Sem. Cred
Ma 222	Probability & Statistics	3	0	3
Ma 525	Intro to Computational Sci	3	0	3
PEP 242	Modern Physics	3	0	3
TE	Technical Elective	3	0(3)	3(4)
Hu	Humanities	3	0	3
PE 200	Physical Education VI	0	2	1
TOTAL		15	2(5)	16(17)

**Senior Year
Term VII**

		Hrs. Per Wk.		
		Class	Lab	Sem. Cred.
TE	Technical Elective	3	0(3)	3(4)
TE	Technical Elective	3	0(3)	3(4)
E	Elective	3	0	3
Hu	Humanities	3	0	3
TOTAL		12	0(6)	12(14)

Term VIII

		Hrs. Per Wk.		
		Class	Lab	Sem. Cred
TE	Technical Elective	3	0(3)	3(4)
TE	Technical Elective	3	0(3)	3(4)
E	Elective	3	0	3
Hu	Humanities	3	0	3
TOTAL		12	0(6)	12(14)

Application Areas

Application Areas correspond to the research interests of the faculty associated with the program and are subject to change. Sample selections of application courses are given below. In addition, Ma 547 Advanced Calculus I and Ma 548 Advanced Calculus II are strongly recommended for students considering graduate school in any field. Note that 600-level courses require special permission. For further information about an Application Area, consult the faculty advisor for that area.

Computational Biology (Professor Panikov)

- Ch 241 Organic Chemistry I
- Ch 242 Organic Chemistry II
- Ch 580 Biochemistry I

Ch 498 Senior Chemical/Biological Research I

one of the following:

- Ch 499 Senior Chemical/Biological Research II
- Ch 678 Computational Microbiology
- Ch 681 Biochemistry II

Computational Chemistry (Professor Mansfield)

Ch 241 Organic Chemistry I
Ch 322 Theoretical Chemistry
Ch 421 Chemical Dynamics
Ch 498 Chemical Research I
Ch 499 Chemical Research II

Computational Mechanics (Professor Hassiotis)

E 126 Mechanics of Solids
CE 345 Modeling and Simulation
CE 373 Structural Analysis
Ma 498 Senior Research Project I

one of the following:

- CE 613 Matrix Analysis of Structures
- CE 623 Structural Dynamics
- CE 681 Introduction to Finite Element Methods

Computational Oceanography (Professor Bruno)

E 126 Mechanics of Solids
CE 342 Fluid Mechanics
OE 526 Computer-Aided Naval Architecture
OE 648 Numerical Hydrodynamics
Ma 498 Mathematical Research I

Computational Physics (Professors Becker and Carr)

PEP 497 SKIL V
PEP 498 SKIL VI
PEP 538 Introduction to Mechanics
PEP 542 Electromagnetism

one of the following:

- PEP 520 Computational Physics
- PEP 575 Fundamentals of Atmospheric Radiation and Climate

Computer Vision (Professors Angelopoulou and Kamberov)

CS 437 Interactive Computer Graphics
CS 638 Interactive Computer Graphics II
CS 558 Computer Vision
CS 499 Computer Science Research II
CS 498 Computer Science Research I

Cybersecurity (Professors Wetzel and Wright)

CS 335 Computational Structures
CS 499 Computer Science Research II
CS 668 Foundations of Cryptography
CS 693 Cryptographic Protocols
CS 498 Computer Science Research I

Environmental Systems (Professor Vaccari)

EN 345 Modeling and Simulation
EN 375 Environmental Systems
EN 541 Fate and Transport of Environmental Contaminants
Ma 498 Mathematical Research I

one of the following:

- Ma 499 Mathematical Research II

— EN 571 Physiochemical Processes for Environmental Control