Stevens Institute of Technology 2006-2007 Catalog

The Arthur E. Imperatore School of Sciences and Arts

Undergraduate Programs

Application Areas

Interdisciplinary Programs: Program in Computational Science

Supervisory Committee

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
Khaldoun Khashanah, Mathematics
Yi Li, Mathematics
Marc Mansfield, Chemistry
Patrick Miller, Mathematics
John Oliensis, Computer Science
Nicolai Panikov, Chemical Biology
Roger Pinkham, Mathematics
Chris Search, Physics
David Vaccari, Environmental Engineering
Susanne Wetzel, 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 and Computer Graphics
- 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/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.

Administrative Directory

Faculty Directory

Travel Directions

Campus Map

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.	
		Class	Lab	Sem. Cred.
MA 115	Calculus I	3	0	3
CH 115	General Chemistry I	3	0	3
CH 117	General Chemistry Lab I	0	3	1
CS 115	Intro. to Computer Science	3	2	4
PEP 111	Mechanics	3	0	3
HUM	Humanities	3	0	3
PE 200	Physical Education I	0	2	1
	TOTAL	**15**	**7**	**18**

Term II

			Hrs. Per Wk.	
		Class	Lab	Sem. Cred
MA 116	Calculus 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
HUM	Humanities	3	0	3
PE 200	Physical Education II	0	2	1
	TOTAL	**15**	**5**	**17**

Sophomore Year

Term III

			Hrs. Per Wk.	
		Class	Lab	Sem. Cred.
MA 221	Differential Equations	4	0	4
MA 134	Discrete Mathematics	3	0	3
MGT	Economics	3	0	3
PEP 221	Physics Lab I	0	3	1
HUM	Humanities	3	0	3
PE 200	Physical Education III	0	2	1
	TOTAL	**13**	**5**	**15**

Term IV

			Hrs. Per Wk.	
		Class	Lab	Sem. Cred
MA 227	Multivariable 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
HUM	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)
HUM	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)
HUM	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
HUM	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
HUM	Humanities	3	0	3
	TOTAL	**12**	**0(6)**	**12(14)**

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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. An additional sixth application course will be chosen with the consent of the advisor. MA 441 Introduction to Mathematical Analysis and MA 442 Real Variables 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 498 Senior Chemical/Biological Research I
CH 580 Biochemistry 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 and Computer Graphics (Professors Angelopoulou, Dinh, Kamberov, and Oliensis)
CS 437 Interactive Computer Graphics
CS 498 Computer Science Research I
CS 499 Computer Science Research II
CS 558 Computer Vision
CS 638 Interactive Computer Graphics II

CyberSecurity (Professors Wetzel and Wright)
CS 335 Computational Structures
CS 498 Computer Science Research I
CS 499 Computer Science Research II
CS 668 Foundations of Cryptography
CS 693 Cryptographic Protocols

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

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