Interdisciplinary Programs

PROGRAM IN COMPUTATIONAL SCIENCE

Supervisory Committee

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David Vaccari, Environmental Engineering
Susanne Wetzel, Computer Science
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UNDERGRADUATE PROGRAM

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 mathematics 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					Term II				
		Hrs. Per Wk.					Hrs. Per Wk.		
		Class	Lab	Sem. Cred.			Class	Lab	Sem. Cred
Ma 115	Math Analysis I	3	0	3	Ma 116	Math Analysis II	3	0	3
Ch 115	General Chemistry I	3	0	3	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
CS 115	Intro to Computer Science	2	2	3	Ch 281	Biology and Biotechnology	3	0	3
PEP 111	Mechanics	3	0	3	PEP 112	Electricity and Magnetism	3	0	3
Hu	Humanities	3	0	3	Hu	Humanities	3	0	3
PE 200	Physical Education I	0	2	1	PE 200	Physical Education II	0	2	1
	TOTAL	**14**	**7**	**17**		**TOTAL**	**15**	**5**	**17**

Sophomore Year

Term III					Term IV				
		Hrs. Per Wk.					Hrs. Per Wk.		
		Class	Lab	Sem. Cred.			Class	Lab	Sem. Cred
Ma 221	Differential Equations	4	0	4	Ma 227	Multivariate Calculus	3	0	3
Ma 334	Discrete Mathematics	3	0	3		Thermodynamics	3	0	3
Mgt	Economics	3	0	3	CS 384	Data Structures & Alg. I	3	0	3
PEP 221	Physics Lab I	0	3	1	PEP 222	Physics Lab II	0	3	1
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	**13**	**5**	**15**		**TOTAL**	**12**	**5**	**14**

Junior Year

Term V					Term VI				
		Hrs. Per Wk.					Hrs. Per Wk.		
		Class	Lab	Sem. Cred.			Class	Lab	Sem. Cred
Ma 232	Linear Algebra	3	0	3	Ma 222	Probability & Statistics	3	0	3
Ma 346	Numerical Methods	3	0	3	Ma 525	Intro to Computational Sci	3	0	3
CS 385	Data Structures & Alg. II	3	0	3	PEP 282	Modern Physics	3	0	3
TE	Technical Elective	3	0(3)	3(4)	TE	Technical Elective	3	0(3)	3(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**	**2(5)**	**16(17)**		**TOTAL**	**15**	**2(5)**	**16(17)**

Senior Year

Term VII					Term VIII				
		Hrs. Per Wk.					Hrs. Per Wk.		
		Class	Lab	Sem. Cred.			Class	Lab	Sem. Cred
TE	Technical Elective	3	0(3)	3(4)	TE	Technical Elective	3	0(3)	3(4)
TE	Technical Elective	3	0(3)	3(4)	TE	Technical Elective	3	0(3)	3(4)
E	Elective	3	0	3	E	Elective	3	0	3
Hu	Humanities	3	0	3	Hu	Humanities	3	0	3
	TOTAL	**12**	**0(6)**	**12(14)**		**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 (Prof. 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 (Prof. 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 (Prof. 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 (Prof. 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 (Profs. 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 (Profs. 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 (Profs. Wetzel and Wright)
CS 335 Computational Structures
CS 499 Computer Science Research II
CS 668 Foundations of Cryptography
CS 693 Cyptographic Protocols
CS 498 Computer Science Research I

Environmental Systems (Prof. 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