Intercollge Programs

Carnegie Mellon University offers several degree programs and courses of study which are coordinated by multiple colleges, reflecting the interdisciplinary nature of the university. These are detailed below.

**BXA Intercollegiate Degree Programs**

The BXA Intercollegiate Degree Programs enable students the freedom to individualize their educational experience by promoting integration, balance and innovation. There are three degree programs from which to choose:

- Bachelor of Humanities and Arts
- Bachelor of Science and Arts
- Bachelor of Computer Science and Arts

For detailed information on the BXA Intercollegiate Degree Programs, go to BXA Intercollege Degree Programs (http://coursecatalog.web.cmu.edu/servicesandoptions/intercollgeprograms/bxaintercollege).

**Bachelor of Science in Computational Biology**

Computational Biology is concerned with solving biological and biomedical problems using mathematical and computational methods. It is recognized as an essential element in modern biological and biomedical research. There have been fundamental changes in biology and medicine over the past decade due to spectacular advances in biomedical imaging, genomics, and proteomics. The nature of these changes demands the application of novel theories and advanced computational tools to decipher the implications of these data, and to devise methods of controlling or modifying biological function. Consequently, Computational Biologists must be well trained and grounded in biology, mathematics, and computer science.

The School of Computer Science and Mellon College of Science have joined forces to establish an exciting interdisciplinary program leading to a B.S. in Computational Biology. The goal of this degree program is to provide an intensive interdisciplinary education to enable outstanding students to become leaders in identifying and solving tomorrow’s biological problems using computational methods. The program’s curriculum is truly interdisciplinary and is designed for students interested in the intersection of Biology and Computer Science.

Applications to the program are invited from current sophomores. Applicants must have completed, or be currently enrolled in 03-231/232 and 15-210 or 15-251. Applicants must submit an essay describing their interest in the program. Completed applications should be submitted to Dr. Becki Campanaro at bmc413@cmu.edu in Doherty Hall 1320, Dr. Phillip Compeau at pcompeau@cs.cmu.edu in Gates-Hillman Center 7403, or Dr. Tom Cortina at tmcortina@cs.cmu.edu in Gates-Hillman Center 4117 no later than one week after midsemester grades are released in a given semester.

Degree Requirements

**47 units Math/Stats Core**

- 21-120 Differential and Integral Calculus 10
- 21-122 Integration and Approximation 10
- 21-127 Concepts of Mathematics 10
- 21-xxx Math Elective (21-241, 21-260, 21-341) 9
- 36-xxx Statistics Elective (36-217, 36-225, 36-247, 36-625) 9

**41 units General Science Core**

- 09-105 Introduction to Modern Chemistry I 10
- 09-106 Modern Chemistry II 10
- 09-217 Organic Chemistry I 9
- 33-121 Physics I for Science Students 12

**51 units Biological Sciences Core**

- 03-121 Modern Biology 9
- 03-231 Biochemistry I 9
- or 03-232 Biochemistry II 9
- 03-220 Genetics 9
- 03-320 Cell Biology 9
- 03-342 Introduction to Biological Laboratory Practices 1
- 03-343 Experimental Techniques in Molecular Biology 12

**360 Minimum number of units required for degree:**

03-201 Undergraduate Colloquium for Sophomores 1
or 15-128 Freshman Immigration Course 1
03-411 Topics in Research 1

* these two courses are co-requisites and must be taken together.

**56 units Computer Science Core**

- 15-122 Principles of Imperative Computation 10
- 15-150 Principles of Functional Programming 10
- 15-210 Parallel and Sequential Data Structures and Algorithms 12
- 15-251 Great Theoretical Ideas in Computer Science 12
- 15-451 Algorithm Design and Analysis 12

**45-54 units Major Electives**

- 03-511 Computational Molecular Biology and Genomics 9
- 03-xxx, 05-xxx, or 02-xxx Computational Biology Electives 18-24
- 03-3xx Advanced Biology Elective 9
- 15-xxx Advanced Computer Science Elective (15-211 or higher) 9

**75 units General Education**

- 99-10x Computing @ Carnegie Mellon 3
- 76-101 Interpretation and Argument 9
- Elective Cognition, Choice and Behavior 9
- Elective Economics, Political and Social Institutions 9
- Elective Cultural Analysis 9
- Non-technical Elective 9
- Non-technical Elective 9
- Non-technical Elective 9
- Non-technical Elective 9

**40-49 units Free Electives**
MCS Science Requirements

Students intending to apply to the B.S. program in Computational Finance should take two semesters of calculus, 21-120 Differential and Integral Calculus and 21-122 Integration and Approximation, and 15-110 Principles of Computing.

In addition, in the freshman year students should complete two of the following three courses:

- 03-121 Modern Biology
- 09-105 Introduction to Modern Chemistry I
- 33-111 Physics I for Science Students

MCS Humanities, Social Sciences & Fine Arts Requirements

Candidates for the B.S. in Computational Finance must complete 72 units offered by Dietrich College of Humanities and Social Science and/or the College of Fine Arts. Of these 72 units, 36 are specified by the detailed curriculum in below. These are:

- 76-101 Interpretation and Argument
- 73-100 Principles of Economics
- 73-230 Intermediate Microeconomics
- 73-240 Intermediate Macroeconomics

Two more nine unit courses must be in specific categories as listed in the section on general requirements for a Bachelor’s degree in the Mellon College of Science. The courses remaining 18 units may be filled by courses from any of the departments in DC, CFA or Tepper, subject to the list of exclusions and additions maintained by MCS.

Tepper Functional Business Core

The Functional Business Core of the Undergraduate Business Administration Program includes 70-122 Introduction to Accounting, which is required by all Computational Finance majors. It also includes 70-391, which Tepper students majoring in Computational Finance must select as one of their Depth electives. In addition, Tepper students pursuing the B.S. in Computational Finance must complete six other courses from the Functional Business Core.

These courses are:

- 70-100 Global Business
- 70-311 Organizational Behavior
- 70-332 Business, Society and Ethics
- 70-371 Operations Management
- 70-381 Marketing I
- 70-401 Management Game

Tepper Breadth Requirements

Candidates for the B.S. in Computational Finance must complete the breadth requirements outlined in the section describing the Undergraduate Business Administration Program.

Depth Electives

The detailed curricula below include three or four depth electives. These may be chosen from among the following:

- 21-355 Principles of Real Analysis I
- 21-365 Projects in Applied Mathematics
- 21-372 Partial Differential Equations and Fourier Analysis
- 36-401 Modern Regression
- 36-402 Advanced Methods for Data Analysis
- 70-391 Finance
- 70-398 International Finance
- 70-492 Investment Analysis
- 70-495 Corporate Finance
- 70-497 Derivative Securities
- 73-372 International Money and Finance

MCS Detailed Curriculum

What follows is the detailed curriculum for the degree Bachelor of Science in Computational Finance in the Mellon College of Science. The courses listed are required. The semesters in which the courses are to be taken are suggested.

Freshman Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Principles of Computing</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Differential and Integral Calculus</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Interpretation and Argument</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Computing @ Carnegie Mellon</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Science Requirement</td>
<td>9-12</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>41-44</td>
</tr>
<tr>
<td>Spring</td>
<td>Fundamentals of Programming and Computer Science</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Integration and Approximation</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Introduction to Accounting</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Science Requirement (9-12 units)</td>
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</tr>
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<td></td>
<td>Elective</td>
<td>9</td>
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Sophomore Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Concepts of Mathematics</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Calculus in Three Dimensions</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Differential Equations</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Principles of Economics</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Humanities, Social Science or Fine Arts Elective</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>46</td>
</tr>
<tr>
<td>Spring</td>
<td>Matrices and Linear Transformations</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Introduction to Mathematical Finance</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Numerical Methods</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Intermediate Microeconomics</td>
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</tr>
<tr>
<td></td>
<td>Elective</td>
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</table>

Junior Year

<table>
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<tr>
<th>Semester</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Principles of Imperative Computation</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Probability</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Discrete Time Finance</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Intermediate Macroeconomics</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>46</td>
</tr>
<tr>
<td>Spring</td>
<td>Continuous-Time Finance</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Introduction to Statistical Inference</td>
<td>9</td>
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<tr>
<td></td>
<td>Introduction to Probability Modeling</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Humanities, Social Science or Fine Arts Elective</td>
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</tr>
<tr>
<td></td>
<td>Depth Elective</td>
<td>9</td>
</tr>
<tr>
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<td>Total</td>
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</table>

Senior Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Studies in Financial Engineering</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Strategic Presentation Skills</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Organizational Design &amp; Implementation</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Depth Elective</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Humanities, Social Science or Fine Arts Elective</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>45</td>
</tr>
</tbody>
</table>
Sophomore Year

Fall
15-110 Principles of Computing 10
21-120 Differential and Integral Calculus 10
or 21-122 Integration and Approximation
70-100 Global Business 9
73-100 Principles of Economics 9
76-101 Interpretation and Argument 9
99-101 Computing @ Carnegie Mellon 3

Spring
15-112 Fundamentals of Programming and Computer Science 12
21-122 Integration and Approximation 10
21-127 Concepts of Mathematics 10
73-230 Intermediate Microeconomics 9
xx-xxx Breadth Course 9
xx-xxx Breadth Course 9

50 Units

Tepper Detailed Curriculum

What follows is the detailed curriculum for the degree Bachelor of Science in Computational Finance in the Tepper School of Business. The courses listed are required. The semesters in which the courses are to be taken are suggested.

Freshman Year

Fall
15-110 Principles of Computing 10
21-120 Differential and Integral Calculus 10
or 21-122 Integration and Approximation
70-100 Global Business 9
73-100 Principles of Economics 9
76-101 Interpretation and Argument 9
99-101 Computing @ Carnegie Mellon 3

Spring
15-112 Fundamentals of Programming and Computer Science 12
21-122 Integration and Approximation 10
21-127 Concepts of Mathematics 10
73-230 Intermediate Microeconomics 9
xx-xxx Breadth Course 9
xx-xxx Breadth Course 9

50 Units

Sophomore Year

Fall
21-259 Calculus in Three Dimensions 9
21-260 Differential Equations 9
21-325 Probability 9
70-122 Introduction to Accounting 9
73-240 Intermediate Macroeconomics 9

45 Units

Spring
21-241 Matrices and Linear Transformations 10
21-270 Introduction to Mathematical Finance 9
36-226 Introduction to Statistical Inference 9
70-311 Organizational Behavior 9
70-381 Marketing I 9

46 Units

Junior Year

Fall
15-122 Principles of Imperative Computation 10
21-370 Discrete Time Finance 9
70-391 Finance 9
xx-xxx Breadth Course 9
xx-xxx Elective 9

46 Units

Spring
21-369 Numerical Methods 9
21-420 Continuous-Time Finance 9
36-410 Introduction to Probability Modeling 9
70-371 Operations Management 9

46 Units

xx-xxx Breadth Course 9

45 Units

Senior Year

Fall
45-925 Studies in Financial Engineering 6
70-332 Business, Society and Ethics 9
70-401 Management Game 12
xx-xxx Breadth Course 9
xx-xxx Depth Elective 9

45 Units

Spring
90-718 Strategic Presentation Skills 6
94-702 Professional Writing 6
or 94-701 Business English 6
xx-xxx Depth Elective 9
xx-xxx Breadth Course 9
xx-xxx Breadth Course 9
xx-xxx Elective 9

48 Units

Minor in Computational Finance

Students do not need to apply for the minor in Computational Finance, however in order to declare the minor in Computational Finance, a student must satisfy one of the following two requirements:

1. Completion of 21-270 Introduction to Mathematical Finance with a grade of A and an overall QPA of at least 3.20.

or

2. Completion of 21-270 Introduction to Mathematical Finance and 21-370 Discrete Time Finance with an average grade of B and an overall QPA of at least 3.00.

When a student has met the necessary requirements, he or she may declare the minor by contacting the Associate Director of the Undergraduate Computational Finance program.

21-241 Matrices and Linear Transformations 9-10
or 21-242 Matrix Theory 9
or 21-341 Linear Algebra 9
21-259 Calculus in Three Dimensions 9
or 21-256 Multivariate Analysis 9
21-260 Differential Equations 9
21-270 Introduction to Mathematical Finance 9
21-370 Discrete Time Finance 9
21-420 Continuous-Time Finance 9

To avoid excessive double counting, Computational Finance minors may not count 21-270 Introduction to Mathematical Finance, 21-370 Discrete Time Finance or 21-420 Continuous-Time Finance toward any other requirement.

The prerequisites for 21-370 are 21-270 and either 21-256 or 21-259 , and the co-require is 70-207 , 21-325 , 36-225 or 36-217. Note that70-207 is not accepted as a prerequisite for 21-420.

The prerequisites for 21-420 are 21-260 , 21-370 and one of the following three calculus based probability courses: 21-325 , 36-225 or 36-217. Note that 70-207 is not a sufficient preparation in probability. Also note that 21-122 is a prerequisite for 21-260 and that 21-127 is a prerequisite for 21-341 and is recommended for 21-241.

Students minoring in Computational Finance are strongly encouraged to take one or two economics course, e.g., 73-100, 73-230 , or 73-240.

Game Design Minor – IDeATe

The Game Design minor is offered by the Entertainment Technology Center as part of the Integrative Design, Arts and Technology (IDeATe) network. IDeATe offers students the opportunity to become immersed in a collaborative community of faculty and peers who share expertise, experience, and passions at the intersection of arts and technology. Students will engage in active “learning by doing” in state-of-the-art maker spaces. The program addresses current and emerging real-world
challenges that require disciplinary expertise coupled with multidisciplinary perspectives and collaborative integrative approaches.

The IDeATe undergraduate curriculum consists of eight interrelated concentration areas, all of which can also be taken as minors. The themes of these areas integrate knowledge in technology and arts: Game Design, Animation & Special Effects, Media Design, Learning Media, Sound Design, Innovation and Entrepreneurship, Intelligent Environments, and Physical Computing. For more information about the IDeATe network, please visit http://coursescatalog.web.cmu.edu/servicesandoptions/undergraduateoptions/#ideate

In the Game Design minor, students are able to enhance their knowledge of key component areas of games such as dramatic narrative and character development, programming and engine development, game assessment and redesign. They will have the opportunity to create games for varied platforms from mobile devices to home entertainment systems and theme parks.

Curriculum

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-104</td>
<td>Introduction to Computing for Creative Practice</td>
<td>10</td>
</tr>
<tr>
<td>62-150</td>
<td>IDeATe: Introduction to Media Synthesis and Analysis</td>
<td>10</td>
</tr>
</tbody>
</table>

* DC, CFA, and TSB students may take 15-112 Fundamentals of Programming and Computer Science as a substitute for 15-104.

Four Collaborative or Supportive Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>05-418</td>
<td>Design Educational Games</td>
<td>12</td>
</tr>
<tr>
<td>15-466</td>
<td>Computer Game Programming</td>
<td>12</td>
</tr>
<tr>
<td>53-230</td>
<td>Programming for Game Designers</td>
<td>12</td>
</tr>
<tr>
<td>53-371</td>
<td>Role Playing Games Writing Workshop</td>
<td>12</td>
</tr>
<tr>
<td>53-409</td>
<td>Game Design</td>
<td>12</td>
</tr>
<tr>
<td>53-451</td>
<td>Research Issues in Game Development</td>
<td>10</td>
</tr>
<tr>
<td>53-471</td>
<td>Game Design, Prototyping and Production</td>
<td>12</td>
</tr>
<tr>
<td>60-419</td>
<td>Advanced ETB: Experimental Game Design</td>
<td>10</td>
</tr>
<tr>
<td>60-333</td>
<td>Character Rigging for Production</td>
<td>10</td>
</tr>
</tbody>
</table>

Electives

Students may take a collaborative or supportive course from one of the other IDeATe areas as one of their four collaborative or supportive courses toward the Game Design minor.

Double-Counting Restriction

Students may double-count two of their Game Design minor courses for other requirements.

Minor in Health Care Policy and Management

Sponsored by:

H. John Heinz III College
Dietrich College of Humanities and Social Sciences
Mellon College of Science

Faculty Advisors:

Jason D’Antonio, Mellon College of Science
James F. Jordan, H. John Heinz III College

The face of health care is changing. The practice of medicine is being fundamentally altered by the forces of change in public policy, health care organizations and in the industry as a whole. The role of individual professionals in this industry is changing as rapidly as the industry itself. Traditional career paths have disappeared overnight to be replaced by new opportunities that require new skills. New organizations are placing new demands on their professional and medical staffs. The criteria of efficiency and financial stability are entering the domains of diagnosis and treatment.

This minor is designed to provide students considering a career in the health professions with an understanding of how these changes are likely to affect their careers. Students will become familiar with the critical policy and management issues and will begin to learn to operate effectively in the emerging health care environment. The curriculum combines economic, organizational, managerial, historical and psychological perspectives on these issues to provide a foundation for a deepened understanding of the changing structure of health care organizations and policy.

Required Courses for HCPM Minor (42 Unit minimum)

Seven courses (a minimum of 60 units) are required to complete this minor. Entry into the minor requires completion of 73-100 Principles of Economics or 88-220 Policy Analysis I or the equivalent by approval.

Required Courses

Students are required to take the following courses.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>79-332</td>
<td>Medical Anthropology</td>
<td>9</td>
</tr>
<tr>
<td>94-705</td>
<td>Health Economics</td>
<td>12</td>
</tr>
<tr>
<td>90-836</td>
<td>Health Systems</td>
<td>6</td>
</tr>
<tr>
<td>90-861</td>
<td>Health Policy</td>
<td>6</td>
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</table>

Elective Courses 24 units

Complete a minimum of 24 units.

Heinz College Courses

<table>
<thead>
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<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>90-721</td>
<td>Healthcare Management</td>
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</tr>
<tr>
<td>90-818</td>
<td>Health Care Quality &amp; Performance Improvement</td>
<td>6</td>
</tr>
<tr>
<td>90-830</td>
<td>Introduction to Financial Management of Health Care</td>
<td>6</td>
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<td>90-831</td>
<td>Advanced Financial Management of Health Care</td>
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</tr>
<tr>
<td>94-706</td>
<td>Healthcare Information Systems</td>
<td>12</td>
</tr>
<tr>
<td>90-832</td>
<td>Health Law</td>
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Humanities and Social Sciences Courses (9 units each)

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>76-494</td>
<td>Healthcare Communications</td>
<td>9</td>
</tr>
<tr>
<td>79-318</td>
<td>Sustainable Social Change: History and Practice</td>
<td>9</td>
</tr>
<tr>
<td>80-245</td>
<td>Medical Ethics</td>
<td>9</td>
</tr>
<tr>
<td>80-247</td>
<td>Ethics and Global Economics</td>
<td>9</td>
</tr>
<tr>
<td>85-241</td>
<td>Social Psychology</td>
<td>9</td>
</tr>
<tr>
<td>85-442</td>
<td>Health Psychology</td>
<td>9</td>
</tr>
<tr>
<td>85-446</td>
<td>Psychology of Gender</td>
<td>9</td>
</tr>
</tbody>
</table>

Please note that some of these courses have prerequisites that will not count toward the completion of the requirements for this minor.

Additional Major in Human-Computer Interaction

Robert Kraut, Undergraduate Advisor
Office: Newell Simon Hall (NSH) 3513
For up to date information, see: http://www.hcii.cmu.edu/applying-undergraduate-major

Overview

Human-Computer Interaction (HCI) is a fast growing field devoted to the design, implementation, and evaluation of interactive computer-based technology. Examples of HCI products include intelligent computer tutors, wearable computers, social networking sites, and internet connected personal digital assistants (PDAs). Constructing an HCI product is a cyclic, iterative process that has at least three stages: Design, Implementation, and Evaluation.

The Design stage involves principles of design and human behavior, the Implementation stage principles of computer science, and the Evaluation stage empirical research methods common to several disciplines. There are thus four topical areas to cover in this major: Human Behavior, Design, Implementation, and Evaluation. In slightly more detail, the major involves the following sorts of knowledge and skill.

Design

- Eliciting from the client, formulating, and articulating functional specifications
- Knowing how human factors and cognitive models should inform design
- Knowing the principles of, and having experience with, communication design
- Understanding how implementation constraints should inform design
- Incorporating evaluation results into iterated designs

Implementation Programming Skills

- Standard programming languages - e.g., C++, Java
- Rapid prototyping skill (e.g., Visual Basic, Flash)
- Computational literacy, i.e., knowledge sufficient for effective communication and decision making about:
- interface construction tools and languages
- multimedia authoring tools
- data structures and algorithms
- Operating systems, platforms, etc.

### Evaluation

- Experimental design
- Focus Groups
- Surveys
- Usability Testing (Cognitive walkthroughs, user models, heuristic evaluation, GOMS)
- Statistical Analysis

There are over 45 courses relevant to these areas that are now offered by eight different departments in four different colleges at Carnegie Mellon (the School of Computer Science, the College of Humanities and Social Sciences, and the College of Fine Arts, and the Tepper School of Business).

### Curriculum

#### Required Courses

**Cognitive Psychology:**

- 85-211 Cognitive Psychology
- or 85-213 Human Information Processing and Artificial Intelligence

**Communication Design Fundamentals:**

- 51-261 Communication Design Fundamentals: Design for Interactions for Communications

**Statistics (one of the following):**

- 36-201 Statistical Reasoning and Practice
- 36-207 Probability and Statistics for Business Applications
- 36-220 Engineering Statistics and Quality Control
- 36-225-36-226 Introduction to Probability Theory - Introduction to Statistical Inference
- 36-247 Statistics for Lab Sciences
- 70-207 Probability and Statistics for Business Applications

**Introduction to Programming:**

- 15-110 Principles of Computing
- or 15-112 Fundamentals of Programming and Computer Science
- or 15-121 Introduction to Data Structures

**Basic Interaction Design:**

- 51-421 Basic Interaction Design
- or 51-422 Interaction Design Studio

**Evaluation (one of the following):**

- 36-202 Statistical Methods
- 36-208 Regression Analysis
- 36-303 Sampling, Survey and Society
- 36-309 Experimental Design for Behavioral and Social Sciences
- 85-310 Research Methods in Cognitive Psychology
- 88-251 Empirical Research Methods
- 70-208 Regression Analysis
- 70-481 Marketing Research

**Human-Computer Interaction Methods**

- 05-410 User-Centered Research and Evaluation

**Interface Programming:**

- 05-430 Programming Usable Interfaces
- or 05-431 Software Structures for User Interfaces
- 05-433 Programming Usable Interfaces OR Software Structures for Usable Interfaces

**Project Course:**

- 05-571 Undergraduate Project in HCI

#### Electives (18 Units)

Electives are intended to provide HCI double majors advanced concepts and skills relevant to HCI or breadth of experience not available from their primary major. Given these goals, most electives will be 300-level courses or higher. Courses at the 100-level and 200-level in one's primary major will not count as electives, although the same course taken by a non-major may count (approval is still required).

Students can take electives in the HCII or courses relevant to HCI from many other departments on campus. All electives are approved on a case-by-case basis. Undergraduate majors request approval of an elective using The HCI Institute's EAsy requirements' management system (http://easy.hcii.cs.cmu.edu/easy). The director of the undergraduate program will approve the request, ask for more information or reject it. The EAsy system then keeps a record of the electives approved for a particular student.

The following courses have been approved as electives in the past, organized by the offering department:

- **Human-Computer Interaction**
  - 05-320 Social Web
  - 05-395 Applications of Cognitive Science
  - 05-413 Human Factors
  - 05-431 Software Structures for User Interfaces
  - 05-540 Rapid Prototyping of Computer Systems
  - 05-589 Independent Study in HCI-UG

- **Machine Learning**
  - 10-601 Introduction to Machine Learning (Masters)

- **Computer Science**
  - 15-390 Entrepreneurship for Computer Science
  - 15-421 Information Security and Privacy
  - 15-437 Web Application Development
  - 15-466 Computer Game Programming

- **Statistics**
  - 36-201 Statistical Reasoning and Practice
  - 36-309 Experimental Design for Behavioral and Social Sciences

- **Architecture**
  - 48-739 Making Things Interactive (Graduate)

- **Design**
  - 51-241 How People Work
  - 51-324 Basic 3D Prototyping
  - 51-383 Topics: Conceptual Models
  - 51-385 Design for Service
  - 51-424 Web Portfolio

- **Business Administration**
  - 70-414 Entrepreneurship for Engineers

#### Double Counting

All prerequisites can be double counted with any requirements in your primary major. At most three non-prerequisite courses can be double counted with the primary major and the HCI second major. For example, if you are majoring in Cognitive Psychology, then you might want to take 85-211 (Intro to Cognitive Psychology) as one of your three double counts. If more than three of the requirements are already in your primary major,
then you must add electives until you have eight HCI courses not required as part of your primary major.

Accelerated Master’s Programs

The HCI Institute currently offers a three semester (12-month), 15 course Masters in HCI. Undergraduates who have taken the core courses, and an elective on the 400 level or above will be considered eligible for the Accelerated Masters program. These students, which include all undergraduate HCI majors, can apply for the Accelerated Masters program by November 1st of their Senior year, and can begin the Masters program in the Spring of their Senior year. They can finish the Masters degree after the Summer and Fall.

Admission to the Major

The HCI undergraduate major is currently available only as a second major. Because space is limited in the major’s required courses, enrollment in the HCI undergraduate major is currently limited to 25 students in each graduating class. 6 with a primary major in Design, 6 in H&SS, 6 in SCS, and 7 anywhere. Applications are processed once a year, during Spring Break. For more detail, see the website: http://hcii.cs.cmu.edu/academics/hci-undergraduate/major/applying.

Bachelor of Science in Music and Technology

The Bachelor of Science in Music and Technology is offered jointly by the School of Music, the School of Computer Science (SCS), and the Carnegie Institute of Technology (CIT).

This program consists of a set of courses that span both music and technology, as well as a capstone composition/design/performance project. Courses in all three areas of study are stipulated in the music and technology undergraduate curriculum and provide for students coming from any of the three areas. In other words, regardless of a student’s entry point—an interest in computer science, electrical engineering, or music—the coursework prescribed will allow the student to gain the requisite knowledge and experience in all three areas. Students will work closely with advisors and will be guided in both course selection and capstone projects.

General Requirements

- **85 units**

  - **Seminar**
    - 57-570 Sound and Music Computing Seminar (8 semesters for a total of 8 units) 8
  - **University**
    - 99-10x Computing @ Carnegie Mellon 3
    - 76-101 Interpretation and Argument 9
    - 79-104 Global Histories 9
  - **Humanities**
    - xx-xxx Cognition, Choice and Behavior course 9
    - xx-xxx English, History, Modern Languages, Philosophy, or Psychology course 9
  - **Mathematics**
    - 21-120 Differential and Integral Calculus 10
    - 21-122 Integration and Approximation 10
  - **Science**
    - 33-114 Physics of Musical Sound 9
    - 33-106 Physics I for Engineering Students 12

  - **Electives33 units**

    - **Music Core87 units**
      - 57-152 Harmony I 9
      - 57-153 Harmony II 9
      - 57-408 Form and Analysis 6
      - 57-151 Counterpoint in Theory and Application 6
      - 57-258 20th-21st Century Techniques 6
      - 57-257 Orchestration I 6
      - 57-xxx Music Support Course 6
      - 57-189 Introduction to Repertoire and Listening for Musicians 3
      - 57-190 Repertoire and Listening for Musicians I 3
      - 57-289 Repertoire and Listening for Musicians II 3
      - 57-290 Repertoire and Listening for Musicians III 3
      - 57-181 Solfege I 3
      - 57-182 Solfege II 3
      - 57-183 Solfege III 3
      - 57-184 Solfege IV 3
      - 57-161 Eurhythmics I 3
      - 57-162 Eurhythmics II 3
      - 57-173 Survey of Western Music History 9

    - **Music and Technology Core120 units**
      - 15-112 Fundamentals of Programming and Computer Science 12
      - 15-122 Principles of Imperative Computation 10
      - 15-322 Introduction to Computer Music 9
      - 18-100 Introduction to Electrical and Computer Engineering 12
      - 18-290 Signals and Systems 12
      - 57-101 Introduction to Music Technology 6
      - 57-347 Electronic and Computer Music 6
      - 57-337 Sound Recording 6
      - 57-338 Sound Editing and Mastering 6
      - 57-438 Multitrack Recording 9
      - 57-571 Music and Technology Project 12
      - 57-572 Music and Technology Project 12

Concentration

Students complete either the Music Concentration or the Technical Concentration:

**Music Concentration60 units**

- 57-5xx Studio (4 semesters) 36
- 57-4xx Major Ensemble (4 semesters) 24

**Technical Concentration57 or 55 units**

- 21-127 Concepts of Mathematics 10
- 15/18-213 Introduction to Computer Systems 12

AND EITHER:

- 18-220 Electronic Devices and Analog Circuits 12
- 18-240 Structure and Design of Digital Systems 12
- 15-2xx/18-3xx Electives in ECE or CS 12

OR:

- 15-128 Freshman Immigration Course 1
- 15-210 Parallel and Sequential Data Structures and Algorithms 12
- 15-323 Computer Music Systems and Information Processing 9
- 15-2xx/18-3xx Electives in ECE or CS 12

Total number of units required for major 380

Bachelor of Science in Neuroscience

Aaron P. Mitchell, Department Head, Biological Sciences

Michael Tarr, Department Head, Psychology

www.cmu.edu/neuro

Neuroscience is an interdisciplinary field in which scientists from many backgrounds apply the tools of biology, cognitive science, psychology, chemistry, mathematics, statistics, computer science, and engineering to develop a comprehensive understanding of brain function at the level of molecules, neurons, brain circuits, cognitive brain modules, and behavior. Research in neuroscience across these disciplines has grown substantially in
the past two decades, and a solid understanding of the physiological basis of many aspects of brain function both in health and disease has come along with this growth in research. Along with this comes an increasing need for students to begin careers in neuroscience and to be prepared to work on brain problems in neuroscience and to bring new answers to the public and to patients. In order to be successful in developing new treatments and answering outstanding questions in the field, neuroscientists need to be conversant in many different levels of inquiry from neurobiology to cognitive neuroscience to computational neuroscience.

The Dietrich College of Humanities & Social Sciences and the Mellon College of Science have joined forces to establish an exciting interdisciplinary program leading to a Bachelor of Science in Neuroscience. The goal of this degree program is to provide an intensive interdisciplinary education to enable outstanding students to become leaders in identifying and solving tomorrow’s Neuroscience problems using a variety of methods. The program’s interdisciplinary curriculum is designed for students to gain a fundamental understanding of brain function on many different levels and to begin to specialize within the broad field of Neuroscience. Students in Mellon College of Science, Dietrich College, or Science and Humanities Scholars Program may have a primary major in Neuroscience in any of the three concentrations.

Students from other colleges may have a second major in Neuroscience in any of the three concentrations, subject to double-counting restrictions.

A degree in neuroscience provides excellent preparation for medical school or other graduate programs in the health professions. These students are aided by the Carnegie Mellon Health Professions Program (HPP), an advisory and resource service for all Carnegie Mellon students who are considering careers in the health care field. (See the HPP (http://courcecatalog.web.cmu.edu/servicesandoptions/undergraduateselectiveoptions#healthprofessionssprogram) section in this catalog or www.cmu.edu/hpp for more information.)

Students wishing to pursue the Neuroscience major through Dietrich College should contact Dr. Lori Holt (loriholt@cmu.edu).

Students wishing to pursue the Neuroscience major through the Mellon College of Science should contact Dr. Becki Campanaro (bcampana@andrew.cmu.edu (mabraun@andrew.cmu.edu)).

Students wishing to pursue an additional major in either the Neurobiology or Computational Neuroscience concentrations should contact Dr. Becki Campanaro (bcampana@andrew.cmu.edu (mabraun@andrew.cmu.edu)).

Students wishing to pursue an additional major in the Cognitive Neuroscience concentration should contact Dr. Lori Holt (loriholt@cmu.edu).

Students who pursue this major will:

- Gain a broad understanding of Neuroscience at many different levels of analysis, including: cellular biology of the brain, brain systems, cognitive brain function, and computational brain modeling
- Gain an understanding of the sciences underlying Neuroscience, including: Biology, Chemistry, Computer Science, Cognition and Psychology, and other emerging areas
- Develop a comprehensive understanding of brain function in health and disease
- Be familiar with neuroanatomy & neurophysiology and their implications for nervous system function
- Be prepared for advanced study in neurobiology, cognitive neuroscience, and/or neural computation
- Be able to collaborate with Neuroscientists across a wide range of systems and levels of analysis
- Prepare for careers in Neuroscience related companies, Neuroscience research, and/or medicine
- Be prepared for specialization within subfields of Neuroscience given their concentration selection

Requirements for a B.S. in Neuroscience

All students must complete the following:

1. General Science Requirements (see section A)  
2. Core Neuroscience Courses (see section B)  
3. Requirements for one concentration (see sections C, D, or E)*  
4. 18 additional relevant course units in their home concentration or other neuroscience areas (some examples listed in sections C, D, E, & F). At least 9 of these units must be at the 300-level or above.
5. Their home college’s General Education requirements
6. Free elective units to come to a total of 360 total course units

* Students may NOT major in two concentrations, but may minor in a related area subject to double-counting restrictions

A. General Science Requirements

<table>
<thead>
<tr>
<th>Units</th>
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<tbody>
<tr>
<td>21-120 Differential and Integral Calculus 10</td>
</tr>
<tr>
<td>21-122 Integration and Approximation 10</td>
</tr>
<tr>
<td>or 21-124 Calculus II for Biologists and Chemists 10</td>
</tr>
<tr>
<td>03-121 Modern Biology 9</td>
</tr>
<tr>
<td>or 03-151 Honors Modern Biology 9</td>
</tr>
<tr>
<td>03-201 Undergraduate Colloquium for Sophomores 1</td>
</tr>
<tr>
<td>03-220 Genetics 9</td>
</tr>
<tr>
<td>09-105 Introduction to Modern Chemistry I 10</td>
</tr>
<tr>
<td>09-106 Modern Chemistry II 10</td>
</tr>
<tr>
<td>09-207 Techniques in Quantitative Analysis 9-12</td>
</tr>
<tr>
<td>or 09-221 Laboratory I: Introduction to Chemical Analysis</td>
</tr>
<tr>
<td>or 03-124 Modern Biology Laboratory</td>
</tr>
<tr>
<td>09-217 Organic Chemistry I 9</td>
</tr>
<tr>
<td>or 33-122 Physics II for Biological Sciences and Chemistry Students</td>
</tr>
<tr>
<td>33-121 Physics I for Science Students 12</td>
</tr>
<tr>
<td>15-110 Principles of Computing 10-12</td>
</tr>
<tr>
<td>or 15-112 Fundamentals of Programming and Computer Science</td>
</tr>
<tr>
<td>36-201 Statistical Reasoning and Practice 2</td>
</tr>
<tr>
<td>or 36-217 Probability Theory and Random Processes 9</td>
</tr>
<tr>
<td>36-247 Statistics for Lab Sciences</td>
</tr>
<tr>
<td>or 36-225 Introduction to Probability Theory 108-113</td>
</tr>
</tbody>
</table>

1 Neurobiology concentration students are required to complete 09-217 & 09-207 or 09-221.
2 Computational Neuroscience concentration students are required to complete 21-122, 15-112, & 36-217

B. Core Neuroscience Courses

<table>
<thead>
<tr>
<th>Units</th>
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<tbody>
<tr>
<td>85-219 Biological Foundations of Behavior 9</td>
</tr>
<tr>
<td>or 03-161 Molecules to Mind 9</td>
</tr>
<tr>
<td>85-211 Cognitive Psychology 9</td>
</tr>
<tr>
<td>or 85-213 Human Information Processing and Artificial Intelligence 9</td>
</tr>
<tr>
<td>03-362 Cellular Neuroscience 9</td>
</tr>
<tr>
<td>03-363 Systems Neuroscience 9</td>
</tr>
<tr>
<td>15-386 Neural Computation 9</td>
</tr>
<tr>
<td>or 85-419 Introduction to Parallel Distributed Processing 9</td>
</tr>
<tr>
<td>or 86-375 Computational Perception 45</td>
</tr>
</tbody>
</table>

C. Neurobiology Concentration

<table>
<thead>
<tr>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>03-231/232 Biochemistry I 9</td>
</tr>
<tr>
<td>03-320 Cell Biology 9</td>
</tr>
</tbody>
</table>

* Neurobiology concentration students must complete 09-217 & 09-207 or 09-221 in their General Science Requirements (section A, above)

Required laboratory, data analysis, & methodological courses

<table>
<thead>
<tr>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>03-343 Experimental Techniques in Molecular Biology 12</td>
</tr>
<tr>
<td>03-346 Experimental Neuroscience 12</td>
</tr>
<tr>
<td>or 03-345 Experimental Cell and Developmental Biology 12</td>
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</tbody>
</table>

Electives in Neurobiology (minimum of 18 additional units)**

<table>
<thead>
<tr>
<th>Units</th>
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<tbody>
<tr>
<td>03-251 Introduction to Computational Molecular Biology 6</td>
</tr>
<tr>
<td>03-252 Introduction to Computational Cell Biology 6</td>
</tr>
<tr>
<td>03-350 Developmental Biology 9</td>
</tr>
<tr>
<td>03-364 Developmental Neuroscience 9</td>
</tr>
<tr>
<td>03-365 Neural Correlates of Learning and Memory 9</td>
</tr>
<tr>
<td>03-366 Biochemistry of the Brain 9</td>
</tr>
<tr>
<td>03-439 Introduction to Biophysics 9</td>
</tr>
<tr>
<td>09-218 Organic Chemistry II 9</td>
</tr>
<tr>
<td>09-222 Laboratory II: Organic Synthesis and Analysis 12</td>
</tr>
</tbody>
</table>
42-202 Physiology  
42-203 Biomedical Engineering Laboratory  
** NOTE: VERY Limited Seating Available for 42-203  
** At least 9 of these units must be 300 level or above  

D. Cognitive Neuroscience Concentration  
Didactic Core. Students must complete all of the following  
85-102 Introduction to Psychology 9  
36-309 Experimental Design for Behavioral and Social Sciences 9  
** 18  
Required laboratory, data analysis, & methodological courses  
85-310 Research Methods in Cognitive Psychology 9  
85-314 Cognitive Neuroscience Research Methods 9  
** 18  
E. Computational Neuroscience Concentration  
Didactic Core. Students must complete all of the following*  
21-217 Concepts of Mathematics 10  
15-122 Principles of Imperative Computation 10  
or 15-150 Principles of Functional Programming  
21-241 Matrices and Linear Transformations 10  
or 21-240 Matrix Algebra with Applications  
** 30  
* Computational Neuroscience concentration students must complete  
21-122, 15-112, and 36-217 in their General Science Requirements (section A, above) and 15-386 in their Core Neuroscience Courses (section B, above).  
Students must complete a minimum of 60 units in this concentration.  
Students should select their required laboratory and elective courses to complete a minimum of 31 units (Four 9 unit courses or a lesser number of 9 and 12 unit courses could be combined to complete this requirement).  
Required laboratory, data analysis, and methodological courses (18-24 total units)  
42-631 Neural Data Analysis 9  
or 86-631 Neural Data Analysis  
42-632 Neural Signal Processing 12  
15-494 Cognitive Robotics: The Future of Robot Toys 12  
15-883 Computational Models of Neural Systems 12  
Electives in Computational Neuroscience (minimum of 9 units)  
03-512 Computational Methods for Biological Modeling and Simulation 9  
or 02-512 Computational Methods for Biological Modeling and Simulation  
10-601 Introduction to Machine Learning (Masters) 12  

15-381 Artificial Intelligence: Representation and Problem Solving 9  
15-387 Computational Perception 9  
15-451 Algorithm Design and Analysis 12  
15-453 Formal Languages, Automata, and Computability 9  
15-494 Cognitive Robotics: The Future of Robot Toys 12  
15-883 Computational Models of Neural Systems 12  
16-299 Introduction to Feedback Control Systems 12  
16-311 Introduction to Robotics 12  
21-228 Discrete Mathematics 9  
or 15-251 Great Theoretical Ideas in Computer Science  
21-259 Calculus in Three Dimensions 9  
21-272 Introduction to Partial Differential Equations 9  
21-341 Linear Algebra 9  
36-208 Regression Analysis 9  
36-226 Introduction to Statistical Inference 9  
36-350 Statistical Computing 9  
36-401 Modern Regression 9  
36-462 Special Topics: Data Mining 9  
42-631 Neural Data Analysis 9  
or 86-631 Neural Data Analysis  
42-632 Neural Signal Processing 12  
F. Additional Neuroscience Electives  
Students are required to take a minimum of 18 additional relevant course units in their home concentration or other neuroscience areas. Some examples are listed in sections C, D, & E above as well as in the list below. At least 9 of these units must be at the 300-level or above.  
NOTE: this list is not restrictive. Concentration advisors can approve additional elective courses that contribute to the student’s neuroscience education, subject to additional approval by the major steering committee.  
Examples of Additional Electives relevant to major*  
33-122 Physics II for Biological Sciences and Chemistry  
Students unless used for Science Core (section A) 9  
76-385 Introduction to Discourse Analysis 9  
80-210 Logic and Proofs 9  
80-211 Logic and Mathematical Inquiry 9  
80-220 Philosophy of Science 9  
80-254 Analytic Philosophy 9  
80-270 Philosophy of Mind 9  
80-280 Linguistic Analysis 9  
80-314 Logic and Artificial Intelligence 9  
* Up to 9 units of applicable undergraduate research course work (e.g. 03-445 or 85-507/85-508) can count as a neuroscience elective (not towards a concentration). A maximum of 27 additional units can be counted as free electives.  
Free Electives (depending on concentration & college)  
TOTAL hours to degree 51-61  
510  

Major in Psychology & Biological Sciences  
This major is intended to reflect the interdisciplinary nature of current research in the fields of biology and psychology, as well as the national trend in some professions to seek individuals broadly trained in both the social and natural sciences.  
Note: Students entering from the Dietrich College of Humanities and Social Sciences will earn a Bachelor of Science in Psychology and Biological Sciences. Students in the Mellon College of Science will earn a Bachelor of Science in Biological Sciences and Psychology. Students in the joint Science and Humanities Scholars (SHS) program can complete the SHS educational core and choose either departmental order for their diploma.  
Depending on a student’s home college (DC or MCS), General Education (GenEd) requirements will be different. GenEd requirements for DC (http://catalogweb.cm. edu/dietrichcollegeofhumanitiesandsocialsciences/ 
#hampssgeneraleducationprogram160) and MCS (http:// 
catalogweb.cm. edu/melloncollegeofscience) are found on their respective Catalog pages. 
Degree Requirements:

Biological Sciences Units
03-121 Modern Biology 9
or 03-151 Honors Modern Biology
03-220 Genetics 9
03-231/232 Biochemistry I 9
03-320 Cell Biology 9
03-343 Experimental Techniques in Molecular Biology 12
03-411 Topics in Research 1
03-412 Topics in Research 1
03-xxx General Biology Elective 1 9
03-3xx Advanced Biology Elective 1 18

Total Biology units 77

Please see description and requirements for electives under the B.S. in Biological Sciences section of this catalog.

Mathematics, Statistics, Physics and Computer Science Units
21-120 Differential and Integral Calculus 10
21-122 Integration and Approximation 10
or 21-124 Calculus II for Biologists and Chemists
36-247 Statistics for Lab Sciences 9
or 36-201 Statistical Reasoning and Practice
36-309 Experimental Design for Behavioral and Social Sciences 9
33-121 Physics I for Science Students 12

Total Science units 63-65

Chemistry Units
09-105 Introduction to Modern Chemistry I 10
09-106 Modern Chemistry II 10
09-217 Organic Chemistry I 9
or 09-219 Modern Organic Chemistry
09-218 Organic Chemistry II 9
or 09-220 Modern Organic Chemistry II
09-207 Techniques in Quantitative Analysis 9-12
or 09-221 Laboratory I: Introduction to Chemical Analysis
09-208 Techniques for Organic Synthesis and Analysis 9-12
or 09-222 Laboratory II: Organic Synthesis and Analysis

Total Chemistry units 56-62

Psychology Courses Units
85-102 Introduction to Psychology 9
85-219 Biological Foundations of Behavior 9
85-xxx Survey Psychology Courses 18
85-310 Research Methods in Cognitive Psychology 9
or 85-340 Research Methods in Social Psychology
85-320 Research Methods in Developmental Psychology or 85-314 Cognitive Neuroscience Research Methods
85-330 Analytic Research Methods or 85-330
85-xxx Advanced Psychology Electives 18

Total Psychology units 63

* Excluding 85-261 Abnormal Psychology

Additional Advanced Elective

9 units(Choose one of the following courses)
85-3xx Advanced Psychology Elective 9
or 03-3xx Advanced Biology Elective 9

Additional Laboratory or Research Methods

9-12 units(Choose one of the following courses)
03-344 Experimental Biochemistry 12
03-345 Experimental Cell and Developmental Biology 12

85-310 Research Methods in Cognitive Psychology 9
85-314 Cognitive Neuroscience Research Methods 9
85-320 Research Methods in Developmental Psychology 9
85-340 Research Methods in Social Psychology 9

Elective Units Free Electives 33-36
MCS Nontechnical Breadth or DC General Education requirements 36-48

Total Elective units 69-84

360

Minimum number of units required for degree:

Science and Humanities Scholars Program

Sponsored by the Dietrich College of Humanities and Social Sciences and by the Mellon College of Science
Dr. William Alba, Director
Office: Doherty Hall, Room 2201
www.cmu.edu/shs

The Science and Humanities Scholars (SHS) Program supports undergraduate students seeking to build their education upon a solid academic foundation in the humanities, social sciences, natural sciences, and mathematics. Students in the program, whether formally enrolled in the Mellon College of Science (MCS) or the Dietrich College of Humanities and Social Sciences (DC), can readily access the resources of both colleges. The SHS General Education curriculum enables students to prepare for any field of study in two colleges while exploring the entire university.

Science and Humanities Scholars in their first year may choose to live in a Stever House residential cluster that promotes the integration of academic and social interests. The program additionally provides students with interdisciplinary and multidisciplinary courses and activities.

Before a student declares a major, the Program Director serves as the student’s primary academic advisor, complementing the range of other advising opportunities available around the university. After a student declares a major, the Director continues to provide supplementary advising for the student, especially on matters of General Education.

Entering first-year students who apply to DC or MCS with outstanding credentials may receive an invitation to the SHS Program. Invited students should carefully consider whether this academic program matches their own scholarly interests. Students enrolled in either college may also request to transfer into the Science and Humanities Scholars Program after completing at least one semester at the university.

Science and Humanities Scholars General Education Program

The requirements in the SHS General Education Program are designed to expose students to a variety of subjects and methodologies, in order to enable them to become better citizens of the world and more complete scholars. The curriculum permits flexibility and independence in selecting courses to fulfill these General Education requirements; students in the Program may petition the Director to take alternate courses in addition to the ones listed here.

Mathematical Sciences (20 units)

21-120 Differential and Integral Calculus 10
21-122 Integration and Approximation 10
or 21-124 Calculus II for Biologists and Chemists

Statistical Reasoning (9 units)

Students may select one of the following courses or any other Statistics course at the 200- level or higher.
36-247 Statistics for Lab Sciences 9
36-225 Probability 9
36-201 Statistical Reasoning and Practice 9
36-217 Probability and Random Processes 9
36-225 Introduction to Probability Theory 9

Writing/Expression (9 units)

Language is a tool used to communicate, as well as a way to organize thinking. This university-wide requirement, to be completed in the first year, focuses on the social nature of language and the ways in which writing constitutes thinking.
76-101 Interpretation and Argument
World Cultures (9 units)
This requirement seeks to enable students to recognize how cultures have shaped and continue to shape the human experience, as well as analyze material that provide clues as to how these cultures operate.
79-104 Global Histories
Freshman Seminar (6-9 units)
Students may select seminars offered by the SHS Program, Dietrich College, and the Mellon College of Science, from a list of courses provided every semester. Past and present SHS seminars include:
99-241 Revolutions of Circularity
99-242 Meaning Across the Millennia
99-243 Light from the Enlightenment
99-245 Energy: Science, Society and Communication
Computational Reasoning (9-12 units)
Students may select one of the following courses offered in Computer Science, Mathematical Sciences, Philosophy, or related fields.
21-127 Concepts of Mathematics
21-128 Mathematical Concepts and Proofs
80-210 Logic and Proofs
80-211 Logic and Mathematical Inquiry
80-212 Arguments and Logical Analysis
15-110 Principles of Computing
15-112 Fundamentals of Programming and Computer Science
15-104 Introduction to Computing for Creative Practice
15-121 Introduction to Data Structures
15-122 Principles of Imperative Computation
02-201 Programming for Scientists
Science Core (28 units)
Choose three of the following courses. Science majors with primary majors in the Mellon College of Science must complete at least two that are outside of their major department.
03-121 Modern Biology
or 03-151 Honors Modern Biology
03-230 Intro to Mammalian Physiology
or 42-202 Physiology
09-105 Introduction to Modern Chemistry I
or 09-107 Honors Chemistry: Fundamentals, Concepts and Applications
10-096 Modern Chemistry II
33-111 Physics I for Science Students
33-151 Matter and Interactions I
33-112 Physics II for Science Students
33-152 Matter and Interactions II
Distribution Requirements (36 units)
Choose a minimum of four courses, 9 units per category, totaling at least 36 units. Below are examples of courses satisfying these categories. You are encouraged to identify other courses that could fulfill these requirements; see the SHS Director for prior approval.
Cognition, Choice, and Behavior
Courses in this category use model-based analysis to broaden an understanding of human thinking, choices, and behavior on an individual basis across a variety of settings. The following list includes examples from Philosophy, Psychology, and Social and Decision Sciences.
80-130 Introduction to Ethics
80-150 Nature of Reason
80-180 Nature of Language
80-221 Philosophy of Social Science
80-230 Ethical Theory
80-241 Ethical Judgments in Professional Life
80-270 Philosophy of Mind
85-102 Introduction to Psychology
85-211 Cognitive Psychology
85-221 Principles of Child Development
85-241 Social Psychology
85-251 Personality
85-261 Abnormal Psychology
88-120 Reason, Passion and Cognition
Economic, Political, and Social Institutions
Courses in this category examine the ways in which institutions organize individual preferences and actions into collective outcomes using model-based reasoning. The following list includes examples primarily from Economics, History, and Social and Decision Sciences; similar courses in those and other departments may also fulfill this requirement.
36-303 Sampling, Survey and Society
70-332 Business, Society and Ethics
73-100 Principles of Economics
73-230 Intermediate Microeconomics
79-266 Russian History: From Communism to Capitalism
79-331 Body Politics: Women and Health in America
80-135 Introduction to Political Philosophy
79-350 Early Christianity
80-135 Introduction to Political Philosophy
80-136 Social Structure, Public Policy & Ethics
80-341 Computers, Society and Ethics
84-104 Decision Processes in American Political Institutions
Creative Production and Reflection
Courses in this category encourage exploration of the artistic and intellectual creation of others while allowing for personal expression and reflection upon the creative process.
xx-xxx Courses from the College of Fine Arts (Architecture 48-xxx, Design 51-xxx, Drama 54-xxx, Music 57-xxx, Art 60-xxx, CFA Interdisciplinary 62-xxx)
76-260 Survey of Forms: Fiction
76-262 Survey of Forms: Nonfiction
76-265 Survey of Forms: Poetry
76-269 Survey of Forms: Screenwriting
79-345 Roots of Rock & Roll
80-220 Philosophy of Science
82-1xx Any Elementary Modern Language course
82-2xx Any Intermediate Modern Language course
99-241 Revolutions of Circularity
99-242 Meaning Across the Millennia
Cultural Analysis
Courses in this category explore definitions of culture and the role culture plays in producing different actions and institutions, as well as the roles of institutions, systems, and human actions in shaping cultural contexts.
57-173 Survey of Western Music History
58-342 Managing Across Cultures
76-227 Comedy
76-232 Introduction to African American Literature
76-241 Introduction to Gender Studies
79-201 Introduction to Anthropology
79-240 Development of American Culture
79-207 Development of European Culture
79-345 Roots of Rock & Roll
79-241 African American History: Africa to the Civil War
79-242 African American History: Reconstruction to the Present
79-224 Mayan America
79-261 The Last Emperors: Chinese History and Society, 1600-1900
79-330 Medicine and Society
80-100 Introduction to Philosophy
80-250 Ancient Philosophy
80-251 Modern Philosophy
80-253 Continental Philosophy
80-254 Analytic Philosophy
80-255 Pragmatism
80-261 Empiricism and Rationalism
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<td>Introduction to Japanese Language and Culture</td>
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<td>Introduction to Hispanic Literary and Cultural Studies</td>
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<td>The Faust Legend at Home and Abroad</td>
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