Mellon College of Science

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The Mellon College of Science (MCS) has provided the undergraduate training for many of today’s leading scientists. We have earned national recognition for our integration of undergraduate education and research from such organizations as the National Science Foundation, the Howard Hughes Medical Institute, and the Beckman Foundation. MCS students gain a broad education in science, mathematics, and the liberal arts while using state-of-the-art computational approaches in their courses, laboratories, and research activities. Our faculty members are committed to teaching as well as to a wide range of scientific research. This combined emphasis on education and research brings special benefits to students, including increased awareness of current scientific developments that are incorporated in classroom instruction, and, most importantly, opportunities to participate with faculty, graduate students, and other research scientists in a variety of research projects.

In the context of rigorous training in each field, the MCS curriculum emphasizes problem-solving, communication, and analytical skills, and it teaches our students the value of hard work and discipline. Our students go on to highly successful careers in a broad range of fields like astrophysics, biotechnology, computer science, business management, environmental science, health care policy, investment banking, marketing analysis, medicine, patent law, and pharmaceuticals. Our alumni credit their education in science for preparing them for a lifetime of learning and achievement; their employers attest to their ability to succeed and to continue learning in an ever-changing world.

The MCS Departments of Biological Sciences, Chemistry, Mathematical Sciences, and Physics each outline their degree programs and courses in the departmental sections. Students select their major in the spring of the first year so that the sophomore year begins with a focus within a department. Most of the courses required within a major are scheduled in the sophomore and junior years, leaving much of the senior year and part of the junior year open for electives. This provides the opportunity to participate in undergraduate research, explore interdisciplinary studies, study abroad, pursue additional majors or minors in other fields, or take other specialty courses oriented toward immediate job placement upon graduation or entry into graduate studies.

Science education in the 21st Century demands educational experiences that are much broader than the traditional preparation of a scholar in a chosen field of science. We want our MCS graduates to be scholars who are deeply trained in their discipline(s), and also professionals adept at communicating to broad audiences, accustomed to working in diverse, multidisciplinary teams, and keenly aware of the global context of their work. We want them to be citizens who are actively involved and globally engaged, and to grow as persons with a sense of wellness and balance.

With these ambitions in mind, we have set forth fifteen (15) outcomes that all MCS undergraduate students should complete in their time at Carnegie Mellon. Upon graduation, MCS students should be able to:

1. Apply foundational and advanced mathematical and scientific knowledge in a chosen field of study appropriately and fluently to solve complex problems, to integrate concepts across disciplines, and to adapt their knowledge to new situations.
2. Critically assess their current state of knowledge and expertise and acquire new knowledge in pursuit of both specific scientific goals and new intellectual interests broadly throughout their lifetime.
3. Communicate effectively via oral, visual, and written formats with an understanding of the perspectives and expectations of diverse audiences, including those within their chosen discipline, outside that discipline (but within STEM), and non-scientists.
4. Participate effectively in multidisciplinary research and/or other teams pursuing a shared vision while optimizing team outcomes.
5. Use the appropriate tools and required media literacy to acquire, assess, and analyze data and information from diverse sources.
6. Recognize and explain the importance of at least one current research topic in a STEM field outside of their major.
7. Recognize and explain the similarities and differences in analyzing/approaching problems, including in technical and non-technical fields other than their major.
8. Demonstrate knowledge of the arts, humanities, and social sciences.
9. Recognize the interplay of science, society, public policy, business, and economics.
10. Identify global examples of the reciprocal relationships among science, technology, political forces, societal contexts, and environmental issues.
11. Describe multiple similarities and differences between one’s own culture and that of others.
12. Engage in recursive, reflective processes to assess their own levels of physical, emotional, and social wellness and then to choose activities that promote these aspects of wellness.
13. Engage in recursive, reflective processes to balance multiple endeavors by setting priorities and managing time in academic, meta-curricular, and personal dimensions.
14. Recognize ethical issues and appreciate the complexities of interrelationships among them, and the use of information in ethical and legal manners.
15. Articulate how one’s own developing skills in science and technology can be increasingly used in constructive community service or engagement that recognizes the potential impact on local and global issues, including environmental impact and sustainability.

Tailoring Your Education

The Mellon College of Science offers students tremendous opportunity for tailoring their education to meet individual professional objectives. Whether you target your degree to a particular field in your discipline via departmental options and concentrations, add a secondary major, minor, or degree to your primary degree program, participate in honors programs, or pursue a master’s degree along with your bachelor’s degree, MCS has much to offer you. Many of these opportunities are outlined below.

Departmental Concentrations

Each department in MCS offers degrees and programs that allow students to explore particular fields within a science discipline. These are outlined below — see the departmental sections for further details.

Biological Sciences
- Biochemistry
- Biophysics
- Cell Biology
- Computational Biology
- Developmental Biology
- Genetics
- Molecular Biology
- Neuroscience

Chemistry
- Biochemistry
- Biological Chemistry
- Colloids, Polymers, and Surfaces
- Computational Chemistry
- Environmental Chemistry
- Management
- Material Chemistry
- Polymer Science

Mathematical Sciences
- Computational and Applied Mathematics
- Computational Finance
- Discrete Mathematics and Logic
- Mathematics
- Operations Research
- Statistics

Physics
- Applied Physics
- Astrophysics
- Biological Physics
- Chemical Physics
- Computational Physics

Minors, Double Majors, and Double Degrees

As an MCS student, you can pursue additional majors and minors to complement your primary degree, not only within the science college, but also through the other
colleges at Carnegie Mellon. Carnegie Mellon offers many exciting interdisciplinary majors and minors, some of which are listed below. In addition, every college and most departments have designed minors or second majors in their discipline so that you can gain expertise in their fields as well.

Some students choose to gain this expertise by following a double degree program. This results in two distinct bachelor’s degrees. Please see the section on Undergraduate Academic Regulations for a more formal definition of these “Multiple Degree” programs.

Interdisciplinary Majors and Minors

Here is a sampling of just a few of the interdisciplinary minors and majors offered at Carnegie Mellon. Please see the appropriate sections elsewhere in this catalog for specific descriptions and course requirements.

• Biological Sciences and Psychology Major
  • Computer Science Minor
  • Engineering Studies Minor
  • Environmental Policy Major
  • Health Care Policy and Management Minor
  • International Affairs Minor
  • Mathematics and Economics Major
  • Neuroscience Major and Minor
  • Robotics Minor
  • Scientific Computing Minor
  • Technology and Policy Minor

For a complete list of the minors offered at Carnegie Mellon, please go to Undergraduate Options (http://coursecatalog.web.cmu.edu/servicesandoptions/undergraduateoptions).  

University Self-Defined Majors

With a well-thought proposal, you may be able to pursue a major you have designed to meet your particular interests and goals. Please see the catalog section on Undergraduate Options (http://coursecatalog.web.cmu.edu/servicesandoptions/undergraduateoptions).

General Education Requirements

Students pursuing any MCS bachelor’s degree will fulfill the 15 Core Education outcomes through their primary MCS major and by completing the following technical and nontechnical breadth requirements prior to graduation.

Technical Breadth Requirements

As a 21st Century practicing scientist or mathematician, our graduates will work with others from a variety of technical backgrounds. Therefore, all of our students will be broadly trained within the technical fields of science and math. Students will fulfill this training by completing four (4) technical courses in the Science, Technology, Engineering, and/or Mathematics (STEM) fields at Carnegie Mellon University.

A student must take at least 9 units, outside of their primary major Department, from each of 4 categories listed below. These may include pre-requisite courses or courses required by their major Department but must be outside their home Department. AP/IB/Cambridge credit may not be used to fulfill these requirements. At least 3 of these courses must be taken in their first year. The categories are:

A. Life Sciences  
(Refer to your specific department for how this category should be fulfilled. Some courses have pre-requisites that can be satisfied by AP, IB, Cambridge A Level Exams. Please check the prerequisites requirements as necessary.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-223</td>
<td>Personalized Medicine: Understanding Your Own Genome</td>
<td>9</td>
</tr>
<tr>
<td>02-261</td>
<td>Quantitative Cell and Molecular Biology Laboratory</td>
<td>9</td>
</tr>
<tr>
<td>03-115</td>
<td>Phage Genomics Research</td>
<td>6</td>
</tr>
<tr>
<td>03-116</td>
<td>Phage Genomics Research</td>
<td>6</td>
</tr>
<tr>
<td>03-121</td>
<td>Modern Biology</td>
<td>9</td>
</tr>
<tr>
<td>03-124</td>
<td>Modern Biology Laboratory</td>
<td>9</td>
</tr>
<tr>
<td>03-125</td>
<td>Evolution</td>
<td>9</td>
</tr>
<tr>
<td>03-127</td>
<td>How Biological Experiments Work - A Project Course</td>
<td>9</td>
</tr>
<tr>
<td>03-133</td>
<td>Neurobiology of Disease</td>
<td>9</td>
</tr>
<tr>
<td>03-161</td>
<td>Molecules to Mind</td>
<td>9</td>
</tr>
<tr>
<td>03-231</td>
<td>Biochemistry I</td>
<td>9</td>
</tr>
<tr>
<td>or 03-232</td>
<td>Biochemistry I</td>
<td>9</td>
</tr>
<tr>
<td>03-250</td>
<td>Introduction to Computational Biology</td>
<td>12</td>
</tr>
<tr>
<td>42-101</td>
<td>Introduction to Biomedical Engineering</td>
<td>12</td>
</tr>
<tr>
<td>42-202</td>
<td>Physiology</td>
<td>9</td>
</tr>
<tr>
<td>85-219</td>
<td>Biological Foundations of Behavior</td>
<td>9</td>
</tr>
</tbody>
</table>

B. Physical Sciences  
(Refer to your specific department for how this category should be fulfilled. Some courses have pre-requisites that can be satisfied by AP, IB, Cambridge A Level Exams. Please check the prerequisites requirements as necessary.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>09-105</td>
<td>Introduction to Modern Chemistry I</td>
<td>10</td>
</tr>
<tr>
<td>09-106</td>
<td>Modern Chemistry II</td>
<td>10</td>
</tr>
<tr>
<td>09-107</td>
<td>Honors Chemistry: Fundamentals, Concepts and Applications</td>
<td>10</td>
</tr>
<tr>
<td>09-214</td>
<td>Physical Chemistry</td>
<td>9</td>
</tr>
<tr>
<td>09-217</td>
<td>Organic Chemistry I</td>
<td>9</td>
</tr>
<tr>
<td>09-219</td>
<td>Modern Organic Chemistry</td>
<td>10</td>
</tr>
<tr>
<td>09-221</td>
<td>Laboratory I: Introduction to Chemical Analysis</td>
<td>12</td>
</tr>
<tr>
<td>09-225</td>
<td>Climate Change: Chemistry, Physics and Planetary Science</td>
<td>9</td>
</tr>
<tr>
<td>09-348</td>
<td>Inorganic Chemistry</td>
<td>10</td>
</tr>
<tr>
<td>33-121</td>
<td>Physics I for Science Students</td>
<td>12</td>
</tr>
<tr>
<td>33-122</td>
<td>Physics II for Biological Sciences &amp; Chemistry Students</td>
<td>9</td>
</tr>
<tr>
<td>33-141</td>
<td>Physics I for Engineering Students</td>
<td>12</td>
</tr>
<tr>
<td>33-142</td>
<td>Physics II for Engineering and Physics Students</td>
<td>12</td>
</tr>
<tr>
<td>33-151</td>
<td>Matter and Interactions I</td>
<td>12</td>
</tr>
<tr>
<td>33-152</td>
<td>Matter and Interactions II</td>
<td>12</td>
</tr>
<tr>
<td>33-211</td>
<td>Physics III: Modern Essentials</td>
<td>10</td>
</tr>
<tr>
<td>33-224</td>
<td>Stars, Galaxies and the Universe</td>
<td>9</td>
</tr>
<tr>
<td>33-225</td>
<td>Quantum Physics and Structure of Matter</td>
<td>9</td>
</tr>
</tbody>
</table>

C. Mathematics, Statistics, and Computer Science  
(Refer to your specific department for how this category should be fulfilled. Some courses have pre-requisites that can be satisfied by AP, IB, Cambridge A Level Exams. Please check the prerequisites requirements as necessary.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-201</td>
<td>Programming for Scientists</td>
<td>10</td>
</tr>
<tr>
<td>21-120</td>
<td>Differential and Integral Calculus</td>
<td>10</td>
</tr>
<tr>
<td>21-122</td>
<td>Integration and Approximation</td>
<td>10</td>
</tr>
<tr>
<td>21-124</td>
<td>Calculus II for Biologists and Chemists</td>
<td>10</td>
</tr>
<tr>
<td>21-127</td>
<td>Concepts of Mathematics</td>
<td>10</td>
</tr>
<tr>
<td>21-228</td>
<td>Mathematical Concepts and Proofs</td>
<td>12</td>
</tr>
<tr>
<td>21-229</td>
<td>Discrete Mathematics</td>
<td>9</td>
</tr>
<tr>
<td>21-241</td>
<td>Matrices and Linear Transformations</td>
<td>10</td>
</tr>
<tr>
<td>or 21-240</td>
<td>Matrix Algebra with Applications</td>
<td>10</td>
</tr>
<tr>
<td>or 21-242</td>
<td>Matrix Theory</td>
<td>9</td>
</tr>
<tr>
<td>21-259</td>
<td>Calculus in Three Dimensions</td>
<td>9</td>
</tr>
<tr>
<td>or 21-268</td>
<td>Multidimensional Calculus</td>
<td>9</td>
</tr>
<tr>
<td>or 21-269</td>
<td>Vector Analysis</td>
<td>9</td>
</tr>
<tr>
<td>21-260</td>
<td>Differential Equations</td>
<td>9</td>
</tr>
<tr>
<td>or 21-261</td>
<td>Introduction to Ordinary Differential Equations</td>
<td>9</td>
</tr>
<tr>
<td>36-200</td>
<td>Reasoning with Data</td>
<td>9</td>
</tr>
<tr>
<td>36-201</td>
<td>Statistical Reasoning and Practice</td>
<td>9</td>
</tr>
<tr>
<td>36-202</td>
<td>Methods for Statistics and Data Science</td>
<td>9</td>
</tr>
<tr>
<td>36-217</td>
<td>Probability Theory and Random Processes</td>
<td>9</td>
</tr>
<tr>
<td>36-220</td>
<td>Engineering Statistics and Quality Control</td>
<td>9</td>
</tr>
<tr>
<td>36-225</td>
<td>Introduction to Probability Theory</td>
<td>9</td>
</tr>
<tr>
<td>36-247</td>
<td>Statistics for Lab Sciences</td>
<td>9</td>
</tr>
<tr>
<td>36-309</td>
<td>Experimental Design for Behavioral and Social Sciences</td>
<td>9</td>
</tr>
<tr>
<td>15-110</td>
<td>Principles of Computing</td>
<td>10</td>
</tr>
<tr>
<td>15-112</td>
<td>Fundamentals of Programming and Computer Science</td>
<td>12</td>
</tr>
<tr>
<td>15-122</td>
<td>Principles of Imperative Computation</td>
<td>10</td>
</tr>
<tr>
<td>15-150</td>
<td>Principles of Functional Programming</td>
<td>10</td>
</tr>
</tbody>
</table>
All candidates for MCS bachelor’s degrees must complete the following non-technical breadth requirements to maximize their CMU experience. Students will be well trained to be life-long and life-wide learners that will lead the scientific community and the world at large.

Biological Sciences
1. Life Sciences: any courses in this category except for the 03-XXX courses
2. Physical Sciences: 09-105, 09-106, 33-121 and 33-122
3. Math/CIS/Stats: 21-120 and (21-122 or 21-124)
4. STEM Elective: will be filled by courses above or any STEM course from the approved list.

Chemistry
1. Life Sciences: 03-121 or 03-231 or 03-232
2. Physical Sciences: 33-121 and 33-122
3. Math/CIS/Stats: 21-120 and (21-122 or 21-124)
4. STEM Elective: will be filled by courses above or any STEM course from the approved list.

Mathematical Sciences
1. Life Sciences: any courses in this category
2. Physical Sciences: any course in this category
3. Math/CIS/Stats: any course in this category except for the 21-XXX courses and 36-200 Reasoning with Data, 36-201, and 36-202
4. STEM Elective: any STEM course from the approved list.

Physics
1. Life Sciences: 03-121
2. Physical Sciences: 09-105
4. STEM Elective: will be fulfilled by courses above or any STEM course from the approved list.

Nontechnical Breadth Requirements
MCS aspires for all of our undergraduates to leave our campus with a strong sense of personal integrity, social responsibility, ethics, working with diverse others, global engagement, and personal health and well-being. The following non-technical breadth requirements will require students to develop a personalized plan for their course selection and meta-curricular participation to maximize their CMU experience. Our graduates will be well trained to be life-long and life-wide learners that will lead the scientific community and the world at large.

A. The following three courses must be taken in the first year:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>38-101</td>
<td>EUREKA!: Discovery and Its Impact</td>
<td>6</td>
</tr>
<tr>
<td>76-101</td>
<td>Interpretation and Argument</td>
<td>9</td>
</tr>
<tr>
<td>99-101</td>
<td>Computing @ Carnegie Mellon</td>
<td>3</td>
</tr>
<tr>
<td>or 99-102</td>
<td>Computing @ Carnegie Mellon</td>
<td></td>
</tr>
</tbody>
</table>

B. The following course must be taken in the Spring of the junior year:

38-301 PROPEL

C. ENGAGE Courses:
The ENGAGE courses are self-directed learning opportunities (using the MyCORE online platform) designed to enhance students’ engagement with wellness, the arts and community service. Please see the course description for information on when these courses should be taken:

<table>
<thead>
<tr>
<th>ENGAGE COURSES</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>38-110</td>
<td>ENGAGE in Service</td>
<td>1</td>
</tr>
<tr>
<td>38-220</td>
<td>ENGAGE in the Arts</td>
<td>2</td>
</tr>
<tr>
<td>38-230</td>
<td>ENGAGE in Wellness: Looking Inward</td>
<td>1</td>
</tr>
</tbody>
</table>

D. STEM Course
- All of the above courses
- Any Introductory engineering course from CIT
- A STEM course approved by an MCS advisor

Technical Breadth--Departmental Requirements
Some of the majors in MCS require certain courses from the technical breadth requirement that are necessary for either prerequisite knowledge in the major or scientific breadth. For each of the four majors in MCS the Technical Breadth Requirement is completed as follows. If these requirements are met by AP/IB/ Cambridge A Level Exams, students can choose any course from the categories to fulfill the Technical Breadth Requirement.

Biological Sciences
- Life Sciences: any courses in this category except for the 03-XXX courses
- Physical Sciences: 09-105, 09-106, 33-121 and 33-122
- Math/CIS/Stats: 21-120 and (21-122 or 21-124)
- STEM Elective: will be filled by courses above or any STEM course from the approved list.

Chemistry
- Life Sciences: 03-121 or 03-231 or 03-232
- Physical Sciences: 33-121 and 33-122
- Math/CIS/Stats: 21-120 and (21-122 or 21-124)
- STEM Elective: will be filled by courses above or any STEM course from the approved list.

Mathematical Sciences
- Life Sciences: any courses in this category
- Physical Sciences: any course in this category
- Math/CIS/Stats: any course in this category except for the 21-XXX courses and 36-200 Reasoning with Data, 36-201, and 36-202
- STEM Elective: any STEM course from the approved list.

Physics
- Life Sciences: 03-121
- Physical Sciences: 09-105
- Math/CIS/Stats: 21-120, 21-122, 21-259
- STEM Elective: will be fulfilled by courses above or any STEM course from the approved list.

Nontechnical Breadth Requirements

A. The following three courses must be taken in the first year:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>38-110</td>
<td>ENGAGE in Service</td>
<td>1</td>
</tr>
<tr>
<td>38-220</td>
<td>ENGAGE in the Arts</td>
<td>2</td>
</tr>
<tr>
<td>38-230</td>
<td>ENGAGE in Wellness: Looking Inward</td>
<td>1</td>
</tr>
</tbody>
</table>

D. Cultural/Global Understanding Course:
Cultural or global understanding course(s) may be taken at any time. Nine (9) or more units from the following group of courses will fulfill this requirement. Any student who finds an appropriate Carnegie Mellon course not on the list below that might fulfill this requirement should contact their academic advisor to review the course description to determine if it can be substituted. Cultural and global understanding courses that are taken while studying abroad can be used to fulfill this category. In addition, transfer courses will also be considered for this category. However, this course requirement cannot be satisfied with AP/IB/Cambridge exam credit.

CULTURAL/GLOBAL UNDERSTANDING

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>57-173</td>
<td>Survey of Western Music History</td>
<td>9</td>
</tr>
<tr>
<td>57-209</td>
<td>The Beatles</td>
<td>9</td>
</tr>
<tr>
<td>57-306</td>
<td>World Music</td>
<td>9</td>
</tr>
<tr>
<td>70-342</td>
<td>Managing Across Cultures</td>
<td>9</td>
</tr>
<tr>
<td>73-331</td>
<td>Political Economy of Inequality and Redistribution</td>
<td>9</td>
</tr>
<tr>
<td>76-221</td>
<td>Books You Should Have Read By Now</td>
<td>9</td>
</tr>
<tr>
<td>76-227</td>
<td>Comedy</td>
<td>9</td>
</tr>
<tr>
<td>76-232</td>
<td>Introduction to African American Literature</td>
<td>9</td>
</tr>
<tr>
<td>76-239</td>
<td>Introduction to Film Studies</td>
<td>9</td>
</tr>
<tr>
<td>76-241</td>
<td>Introduction to Gender Studies</td>
<td>9</td>
</tr>
<tr>
<td>76-386</td>
<td>Language &amp; Culture</td>
<td>9</td>
</tr>
<tr>
<td>79-104</td>
<td>Global Histories</td>
<td>9</td>
</tr>
<tr>
<td>79-201</td>
<td>Introduction to Anthropology</td>
<td>9</td>
</tr>
<tr>
<td>79-202</td>
<td>Flesh and Spirit: Early Modern Europe, 1400-1750</td>
<td>9</td>
</tr>
<tr>
<td>79-205</td>
<td>20th/21st Century Europe</td>
<td>9</td>
</tr>
<tr>
<td>79-207</td>
<td>Development of European Culture</td>
<td>9</td>
</tr>
<tr>
<td>79-221</td>
<td>Development and Democracy in Latin America</td>
<td>9</td>
</tr>
<tr>
<td>79-229</td>
<td>Origins of the Arab-Israeli Conflict, 1880-1948</td>
<td>9</td>
</tr>
<tr>
<td>79-230</td>
<td>Arab-Israeli Conflict and Peace Process since 1948</td>
<td>9</td>
</tr>
<tr>
<td>79-240</td>
<td>Development of American Culture</td>
<td>9</td>
</tr>
<tr>
<td>79-241</td>
<td>African American History: Africa to the Civil War</td>
<td>9</td>
</tr>
<tr>
<td>79-242</td>
<td>African American History: Reconstruction to the Present</td>
<td>9</td>
</tr>
<tr>
<td>79-255</td>
<td>Irish History</td>
<td>9</td>
</tr>
<tr>
<td>79-261</td>
<td>The Last Emperors: Chinese History and Society, 1600-1900</td>
<td>9</td>
</tr>
<tr>
<td>79-265</td>
<td>Russian History: From the First to the Last Tsar</td>
<td>9</td>
</tr>
<tr>
<td>79-266</td>
<td>Russian History: From Communism to Capitalism</td>
<td>9</td>
</tr>
<tr>
<td>79-275</td>
<td>Introduction to Global Studies</td>
<td>9</td>
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<td>79-297</td>
<td>Dilemmas and Controversies in Anthropology</td>
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<td>79-307</td>
<td>Religion and Politics in the Middle East</td>
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<td>79-345</td>
<td>Roots of Rock &amp; Roll</td>
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<td>79-349</td>
<td>The Holocaust in Historical Perspective</td>
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<td>79-350</td>
<td>Early Christianity</td>
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<td>79-357</td>
<td>History of Black American Music</td>
<td>9</td>
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<td>79-377</td>
<td>Food, Culture, and Power: A History of Eating</td>
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<td>80-100</td>
<td>Introduction to Philosophy</td>
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<td>80-250</td>
<td>Ancient Philosophy</td>
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<td>80-251</td>
<td>Modern Philosophy</td>
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<td>80-253</td>
<td>Continental Philosophy</td>
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<td>80-254</td>
<td>Analytic Philosophy</td>
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<td>80-255</td>
<td>Pragmatism</td>
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<tr>
<td>80-276</td>
<td>Philosophy of Religion</td>
<td>9</td>
</tr>
<tr>
<td>82-xxx</td>
<td>Any course from Modern Languages</td>
<td>9</td>
</tr>
<tr>
<td>99-241</td>
<td>Revolutions of Circularity</td>
<td>9</td>
</tr>
<tr>
<td>99-xxx</td>
<td>Any of the Country Today courses</td>
<td>3</td>
</tr>
</tbody>
</table>

E. Arts, Humanities, and Social Sciences Courses
To fulfill this requirement, students must complete a minimum of four (4) nontechnical courses totaling at least 36 units in the College of Fine Arts, the Tepper School of Business and/or the Dietrich College for Humanities and Social Sciences. A maximum of 18 units of these units may be fulfilled via AP/IB/Cambridge exam credit. Courses counted toward the Cultural/Global Understanding requirement, and 76-101, do not count toward this requirement.

NOTE** Check our web site for courses from DC, CFA, and Tepper that may NOT be used (http://www.cmu.edu/mcs/undergrad/advising/hss-finearts/deletions.html) to satisfy this requirement because they are too technical in nature, plus a list of courses in other colleges (including SCS, CIT, Tepper, and Heinz College) that do satisfy...
Bachelor of Science and Arts Degree Program (BSA)

Students in the Bachelor of Science and Arts Degree program are jointly admitted to MCS and the College of Fine Arts (CFA). This is a degree program for students who are naturally gifted in both the arts and the sciences, and allows for the combining of talents in these areas. More details can be found at http://coursecatalog.web.cmu.edu/servicesandoptions/intercollegeprograms/bxaintercollege/.

Science and Humanities Scholars Program (SHS)

Students in the Science and Humanities Scholars Program (SHS) are jointly admitted to MCS and the Dietrich College of Humanities and Social Sciences (DC). Participants in this program follow a special general education core, but have the flexibility to choose a primary major in either of the two colleges. More detail can be found at http://coursecatalog.web.cmu.edu/servicesandoptions/intercollegeprograms/.

Honors Degree Programs in MCS

Several of the departments in MCS offer students an opportunity to participate in a departmental honors degree program. Some of these programs result in a master’s degree along with the bachelor’s degree (see next section on accelerated master’s programs). These programs are listed below; see the department’s section of the catalog for more details.

- Honors Program in Research Biology
- Departmental Honors in Chemistry
- Honors B.S./M.S. Program in Chemistry
- Honors B.S./M.S. Program in Mathematical Sciences

Accelerated Master’s Programs

Carnegie Mellon offers some accelerated master’s programs for motivated students, whereby students complete both the bachelor’s and the master’s degree in four or five years. Some programs are in the student’s home department in MCS as part of an honors program, while others are offered through one of our graduate schools at Carnegie Mellon. Below is a listing of the programs currently available to MCS students; please see the appropriate sections of the catalog for more details.

- Honors B.S./M.S. Program in Chemistry
- Honors B.S./M.S. Program in Mathematical Sciences
- Accelerated Master’s Program in the Heinz College

Study Abroad

There are many programs for studying abroad, usually during your junior year. Please see the catalog section on Undergraduate Options for more details, and talk with the Office of International Education to get information and advice specifically for you.

Pre-Professional Programs

Many students in the Mellon College of Science decide to pursue professional training such as medical school or law school after completing their undergraduate work. Carnegie Mellon offers strong advising services to support these students. Through these programs, students get help with everything from course selection to identification of important experiential opportunities to the application process itself.

Health Professions Program

Faculty Contact: Jason D’Antonio

Please see the Undergraduate Options (http://coursecatalog.web.cmu.edu/servicesandoptions/undergraduateoptions/#healthprofessionsprogram) section for details on the Health Professions Program.

Pre-Law Advising Program

Faculty Contact: Joseph Devine

Please see the Undergraduate Options (http://coursecatalog.web.cmu.edu/servicesandoptions/undergraduateoptions/#pre-lawadvisingprogram) section for details on the Pre-Law Advising Program.

Intercollege Programs

MCS participates in two intercollege programs, the Bachelor of Science and Arts Degree program and the Science and Humanities Scholars program. Enrollment for the Science and Humanities program is by invitation only for incoming first-year students, and by application for current students.

Applying Your Education Through Research

An important feature of education in MCS is the opportunity for undergraduate research experience. This experience may be arranged as a course taken for credit or occasionally as a part-time job. Our web site (www.cmu.edu/mcs/) offers a range of useful information including links to faculty research areas, links to undergraduate research programs at other institutions, and ideas on how to get involved. Because of the strong research base of MCS, undergraduate research positions offer an exciting opportunity to apply your theoretical training to participate in the discovery of new knowledge.

Students can earn MCS Research Honors for significant research accomplishments; see the policy outlined below for the requirements.

Mellon College of Science Research Honors

Undergraduates in the Mellon College of Science will be awarded MCS College Honors at the completion of their degree if they have met one of these requirements:

1. Successfully completed the Honors B.S./M.S program in the Department of Chemistry or Department of Mathematical Sciences.
2. Successfully completed the departmental honors program in the Department of Biological Sciences or the Department of Chemistry.
3. Earned a cumulative grade point average of 3.20 or higher and carried out significant research. Typically, this would consist of an academic project carried out for at least two semesters. However, a single project that spans a summer and a semester or that the research mentor deems to be significant and sustained, even if the student worked for pay rather than credit, will be allowed. In addition, some form of public dissemination of this research, which has been approved by the Associate Dean of MCS, such as a peer reviewed publication, research thesis, or presentation at an external scientific meeting is required. The Meeting of the Minds by itself is not sufficient and participation in a preapproved judged competition, such as Sigma Xi, is necessary.

Final approval of nominations for MCS Honors will come from the Dean of MCS and the Associate Dean for Undergraduate Affairs.

Research Centers

The Mellon College of Science is home to a number of innovative research centers. These centers are particularly strong because of the interdisciplinary collaboration of their scientists. This interdisciplinary research brings international prestige to the college. Many students conduct undergraduate research with one of these centers. The Bruce and Astrid McWilliams Center for Cosmology joins research efforts in other disciplines to unravel the mysteries of the universe.

The Center of Atmospheric Particle Study’s goal is to be the world leader in science, engineering, and policy covering the full role of fine particulate matter in the atmosphere. Our goal in research is to advance the state of knowledge across this spectrum substantially, to provide both policy-relevant research, and to participate directly and actively in the evolution of environmental policy related to particulate matter.

The Center for Computational Finance’s mission is to improve the interaction between academic research and the finance industry.

The Center for Macromolecular Engineering’s goals are to enhance the benefits of polymer science to society by developing new methods to prepare advanced polymer materials, train and develop tomorrow’s scientists, and transfer technology to industry.

4. For the Arts, Humanities and Social Sciences Electives requirement, students must complete a minimum of 36 units. For the Technical Breadth category, students must complete a minimum of 36 units.

2. The four courses required for the Technical Breadth category can be completed at Carnegie Mellon or via transfer credit.

1. Students must complete a minimum of 360 units.

The Center for Macromolecular Engineering’s goals are to enhance the benefits of polymer science to society by developing new methods to prepare advanced polymer materials, train and develop tomorrow’s scientists, and transfer technology to industry.

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A student who does not meet minimum standards at the end of one semester of
Suspension that the standards are likely to be met at the end of the next semester of study.
probation and is not yet meeting minimum requirements but whose record indicates
A student is occasionally continued on probation who has had one semester on
academic action. For all subsequent semesters an academic action will be taken if the
minimum of 36 factorable units and earning no incomplete grades.
The student must earn a quality point average of at least 3.5 while completing a
naming them to the Dean's List. The criteria for such recognition are as follows:
MCS Dean's List
Each semester MCS recognizes those students with outstanding academic records by
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Dean’s List
The student must earn a quality point average of at least 3.5 while completing a
minimum of 36 factorable units and earning no incomplete grades.
Dean’s List High Honors
The student must earn a quality point average of at least 3.75 while completing a
minimum of 36 factorable units and earning no incomplete grades.
Probation, Suspension, and Drop
In the first year, quality point averages below 1.75 in either semester invoke an
academic action. For all subsequent semesters an academic action will be taken if the
semester QPA or the cumulative QPA (excluding the first year) is below 2.00.
The progression below between probation, suspension, and drop is typical. However, in
unusual circumstances, MCS College Council may choose to suspend or drop a
student without prior probation.
Probation
The action of probation will be taken if:
- One semester of the first year is below 1.75 QPA.
- The semester QPA of a student in good standing beyond the first year falls below
2.00. The term of probation is one semester as a full-time student. First-year
students are no longer on probation at the end of the second semester if their
semester QPA is 1.75 or above.
A student is occasionally continued on probation who has had one semester on
probation and is not yet meeting minimum requirements but whose record indicates
that the standards are likely to be met at the end of the next semester of study.
Suspension
A student who does not meet minimum standards at the end of one semester of
probation will be suspended.
A first-year student will be suspended if the QPA from each semester is below 1.75.
A student in the third or subsequent semester of study will be suspended if the
semester factor or the cumulative factor (excluding the first year) is below 2.00 for
two consecutive semesters.
The minimum period of suspension is one academic year (two semesters). At the end of
that period a student may return to school on probation by:
- Receiving permission in writing from the Associate Dean of MCS.
- Completing a Return from Leave form from Enrollment Services.
- Providing transcripts and clearance forms if the student has been in a degree
program at another college or university, even though academic credit earned
will not transfer to Carnegie Mellon unless prior approval has been granted by the
Associate Dean.
Employment within the university in non-student jobs is possible for students on
academic suspension, subject to the hiring criteria of the hiring department. However,
a student on academic suspension wishing to accept a job on campus must speak
with the Associate Dean of the student’s college to ensure that the employment
will not constitute a violation of the terms of suspension. The Associate Dean will
generally allow such employment, in consultation with the Dean of Student Affairs.
One employment benefit not available to students on academic suspension who
accept a full-time job with the University is the option to take courses through
remission. The option to take courses becomes available only after the academic
suspension is over.
Drop
This is a permanent severance from the Mellon College of Science. Students are
dropped when it seems clear that they will never be able to meet minimum standards.
A student who has been suspended and who fails to meet minimum standards after
returning to school is dropped.
A student who has been academically dropped or academically suspended and who is
not employed by the University must absent themselves from campus and is, for the
term of the suspension, barred from all activities and affiliations that stem from one's
status as an enrolled student. These include registering or enrolling for courses, sitting
in on classes, living in residence halls or Greek houses, membership and participation in
student activities, and employment in student jobs. (NOTE: Exceptions to the
restriction from student jobs for students on academic suspension will in general be
granted for summer employment if the position was accepted prior to the decision to
suspend.)
Transfer into MCS Departments
Undergraduate students admitted to MCS can choose to pursue any major within
MCS. This choice must be made prior to the first semester of the sophomore year
(normally during the second semester of the first year) and does not require approval
by any department.
Undergraduate students admitted to colleges other than MCS and wishing to transfer
into an MCS department during their first year should consult with the MCS
Associate Dean for Undergraduate Affairs. Students may submit an internal transfer
request no earlier than mid-term of the spring semester of the first year. Potential
transfer students must also have successfully taken 21-120 Differential and Integral
Calculus and, depending on major choice, one of the following: 03-121 Modern
Biology, 09-105 Introduction to Modern Chemistry I, or 33-111 Physics I for Science
Students.
MCS undergraduate students beyond the first year wishing to transfer into another
MCS department may do so if they are not on academic probation and if there is room in
the department of their choice. If the demand for any department exceeds the space
available, then the department will admit students based on a comparative evaluation of
all applicants at the end of each semester, up to the limit of available space.
Undergraduate students not in MCS and wishing to transfer into a department in MCS
beyond the first year will be considered for transfer on a space available/academic
performance basis. An MCS department may refuse a transfer to a non-MCS student
if there are space restrictions and/or if the student’s chance for success is determined
to be questionable based on past academic performance.
Procedure for transfer of students from another university into an MCS department:
A student first applies through the Office of Admission. If the Office of Admission
believes the applicant is acceptable, the student’s record is sent to the appropriate
department for evaluation and a decision on acceptance. The MCS department head
will not transfer to Carnegie Mellon unless prior approval has been granted by the
Associate Dean.
Graduation Requirements
To be eligible to graduate, undergraduate students must complete all course
requirements for their program with a cumulative Quality Point Average of at least 2.0
for all courses taken. For undergraduate students who enrolled at Carnegie Mellon
as freshmen and whose freshman grades cause the cumulative QPA to fall below 2.0,
this requirement is modified to be a cumulative QPA of at least 2.0 for all courses
in materials science. The center has created a vigorous environment for collaboration
among mathematical and allied scientists.
The Center for Nucleic Acids Science and Technology is a community of Carnegie
Mellon scientists and engineers unified by interests in the chemistry, biology, and
physics of DNA, RNA, and PNA (peptide nucleic acid).
The Institute for Green Science has been established as a research, education, and
development center in which a holistic approach to sustainability science is being
developed. The focus of the institute is in three areas: renewable energy technologies,
chemical feedstocks, and benign alternatives to polluting technologies.
The Molecular Biosensor and Imaging Center uses an interdisciplinary approach to
develop reagents, microscopes, and imaging tools and applies them to the
investigation of fundamental problems in biology and biotechnology.
The Pittsburgh Supercomputing Center provides information on advanced scientific
computing for engineering and research.
The Computational Biology Department seeks to realize the potential of machine
learning for expanding our understanding of complex biological systems. A primary
goal of the Center is to develop computational tools that will enable automated
creation of detailed, predictive models of biological processes, including automated
experiment design and data acquisition.

Academic Standards

Academic Actions

MCS Dean’s List
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A first-year student will be suspended if the QPA from each semester is below 1.75.

Mellon College of Science
taken after the freshman year. Note, however, the cumulative QPA that appears on
the student's final transcript will be calculated based on all grades in all courses taken,
including freshman year. Some programs may have additional QPA requirements in
order to graduate. Students are encouraged to confirm all graduation requirements
with their academic advisor.

A minimum of 360 units must be completed. This will include the MCS Technical
and Nontechnical Core Courses and all departmental course requirements.

Students will be required to meet the residency requirement and to have met all
financial obligations to the university before being awarded a degree. The residency
requirement is detailed in the Academic Regulations section of the catalog. A student
may seek permission to modify graduation requirements by petition to the MCS
College Council.

Graduation Honors

There are two types of honors awarded at graduation.

University Honors
University Honors are automatically awarded to students who have earned a
cumulative Q.P.A. of 3.5 or better after seven semesters.

College Research Honors
Please see the section “Mellon College of Science Research Honors” for information
on how to qualify for College Research Honors.

Faculty

WILLIAM ALBA, Assistant Dean for Diversity, Director of Science and Humanities
Scholars Program – Ph.D.,

MAGGIE BRAUN, Associate Dean for Undergraduate Affairs – Ph.D.,

JASON D’ANTONIO, Director of Health Professions Program – Ph.D.,

KENNEITH HOVIS, Assistant Dean for Educational Initiatives – Ph.D.,

CURTIS MEYER, Associate Dean for Faculty and Graduate Affairs – Ph.D.,

Administration

CHARLOTTE BARTOSH, Interdisciplinary Laboratory Research Technician.

CHRISTINE GILCHRIST, Senior Academic Coordinator, MCS.

VERONICA PEET, Senior Academic Advisor, Science and Humanities Scholars
Program.

TARA PRIMIERO, Administrative Coordinator.

MAY SIMAAN, Administrative Coordinator.