

Mellon College of Science General Education

General Education Requirements

Students pursuing any MCS bachelor's degree will fulfill the 15 Core Education outcomes (<http://coursecatalog.web.cmu.edu/schools-colleges/melloncollegeofscience/>) through their primary MCS major and by completing the following technical and nontechnical breadth requirements prior to graduation. Please see MCS Course Planning Guide (<https://www.cmu.edu/mcs/undergrad/course-planning.html>) for the recommended timeline to complete these requirements.

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.

Technical Breadth - Requirements by Department

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

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/CS/Stats: 21-120 and 21-122
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/CS/Stats: 21-120 and 21-122
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/CS/Stats: any course in this category **except** for the 21-XXX courses, 36-200, or 36-202
4. STEM Elective: any STEM course from the approved list

Physics

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

A student must take at least 9 units, outside of their primary major department, from each of four categories listed below. These may include prerequisite 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. When major requirements as detailed above are met by AP/IB/Cambridge A Level Exams, students can choose any course from the broader categories to fulfill the Technical Breadth Requirement. At least three of these courses must be taken in their first year. The categories are:

Technical Breadth - Full list

A. Life Sciences

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

LIFE SCIENCES

02-250	Introduction to Computational Biology	12
02-261	Quantitative Cell and Molecular Biology Laboratory	9
03-117	Frontiers, Analysis, and Discovery in Biological Sciences	6
03-121	Modern Biology	9
03-151	Honors Modern Biology	10
03-124	Modern Biology Laboratory	9
03-125	Evolution	9
03-132	Basic Science to Modern Medicine	9
03-133	Neurobiology of Disease	9
03-135	Structure and Function of the Human Body	9
03-161	Molecules to Mind	9
03-231	Honors Biochemistry	9
or 03-232	Biochemistry I	
42-101	Introduction to Biomedical Engineering	12
42-202	Physiology	9
85-170	Foundations of Brain and Behavior	9

B. Physical Sciences

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

PHYSICAL SCIENCES

09-105	Introduction to Modern Chemistry I	10
09-106	Modern Chemistry II	10
09-107	Honors Chemistry: Fundamentals, Concepts and Applications	10
09-111	Chemical Building Blocks	9
09-214	Physical Chemistry	9
09-217	Organic Chemistry I	9
09-219	Modern Organic Chemistry	10
09-221	Laboratory I: Introduction to Chemical Analysis	12
09-225	Climate Change: Chemistry, Physics and Planetary Science	9
09-348	Inorganic Chemistry	10
33-121	Physics I for Science Students	12
33-122	Physics II for Biological Sciences and Chemistry Students	9
33-141	Physics I for Engineering Students	12
33-142	Physics II for Engineering and Physics Students	12
33-151	Matter and Interactions I	12
33-152	Matter and Interactions II	12
33-211	Physics III: Modern Essentials	10
33-224	Stars, Galaxies and the Universe	9
33-225	Quantum Physics and Structure of Matter	9

C. Mathematics, Statistics, and Computer Science

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

MATH, STATS, and CS

02-120	Programming for Scientists	12
21-120	Differential and Integral Calculus	10
21-122	Integration and Approximation	10
21-127	Concepts of Mathematics	12
21-128	Mathematical Concepts and Proofs	12
21-228	Discrete Mathematics	9

21-241	Matrices and Linear Transformations	10
or 21-240	Matrix Algebra with Applications	
or 21-242	Matrix Theory	
21-259	Calculus in Three Dimensions	10
or 21-268	Multidimensional Calculus	
or 21-269	Vector Analysis	
21-260	Differential Equations	9
or 21-261	Introduction to Ordinary Differential Equations	
36-200	Reasoning with Data	9
36-202	Methods for Statistics & Data Science	9
36-220	Engineering Statistics and Quality Control	9
36-225	Introduction to Probability Theory	9
36-309	Experimental Design for Behavioral & Social Sciences	9
15-110	Principles of Computing	10
15-112	Fundamentals of Programming and Computer Science	12
15-122	Principles of Imperative Computation	12
15-150	Principles of Functional Programming	12
15-251	Great Ideas in Theoretical Computer Science	12

D. STEM Course

- All of the above courses
- Any introductory engineering course from CIT
- A STEM course approved by an MCS advisor

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 nontechnical 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.

All candidates for MCS bachelor's degrees must complete the following nontechnical breadth requirements:

A. First-Year Courses:

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

38-101	EUREKA!: Discovery and Its Impact	6
or 38-100	CATALYST - MCS First-Year Seminar	
First-Year Writing (A total of nine units must be completed in order to fulfill this requirement)		
76-101	Interpretation and Argument	9
or 76-102	Advanced First Year Writing: Special Topics	
or 76-106	Writing about Literature, Art and Culture	
or 76-107	Writing about Data	
or 76-108	Writing about Public Problems	
99-101	Core@CMU	3

B. Science and Society Course:

This requirement must be completed no later than the penultimate semester. Any student who finds an appropriate Carnegie Mellon course not on the pre-approved elective list below that might fulfill this requirement should complete the MCS Course Fulfillments form (https://docs.google.com/forms/d/e/1FAIpQLSdSY7pd4D5LDvCvA0Y0ow97pmiREHcQURm0LNMZ7t_Ir-LAQ/viewform) for course review to determine if it can be substituted. In addition, transfer courses will also be considered for this category. However, this course requirement *cannot* be satisfied with AP/IB/Cambridge exam credit.

- **Option 1:** Take 38-304 Reading and Writing Science
- **Option 2:** Take one of the pre-approved (<https://docs.google.com/spreadsheets/d/17OXQbJtRnburqx570pudYQ7j2YDNP3ntFVH7s1DT5T0/edit?gid=0#gid=0>)electives (<https://docs.google.com/spreadsheets/d/17OXQbJtRnburqx570pudYQ7j2YDNP3ntFVH7s1DT5T0/edit?gid=0#gid=0>)

SCIENCE AND SOCIETY COURSES

*The courses listed below are the top five most popular choices to fulfill this requirement, please use the link above to see the full list of pre-approved electives.

38-304	Reading and Writing Science	6
79-234	Technology and Society	9
09-403	Hooked: The Chemical Basis of Drug Addiction	9
80-249	AI, Society, and Humanity	9
17-200	Ethics and Policy Issues in Computing	9

Note: QBS students should plan to enroll in 38-301 PROPEL in spring of junior year to fulfill this requirement.

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:

ENGAGE COURSES

38-110	ENGAGE in Service	1
38-220	ENGAGE in the Arts	2
38-230	ENGAGE in Wellness: Looking Inward	1
38-330	ENGAGE in Wellness: Looking Outward	var.
or 38-402	MCS Leadership Development Seminar	
38-430	ENGAGE in Wellness: Looking Forward	var.
or 38-402	MCS Leadership Development Seminar	

Option 1: 38-402 may be substituted for BOTH 38-330 AND 38-430. -OR- Option 2: 38-402 may fulfill the Science and Society requirement.

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. Take a pre-approved Cultural/Global Understanding course (<https://docs.google.com/spreadsheets/d/17OXQbJtRnburqx570pudYQ7j2YDNP3ntFVH7s1DT5T0/edit?gid=0#gid=0>). Any student who finds an appropriate Carnegie Mellon course not on the list that might fulfill this requirement should complete the MCS Course Fulfillments form (https://docs.google.com/forms/d/e/1FAIpQLSdSY7pd4D5LDvCvA0Y0ow97pmiREHcQURm0LNMZ7t_Ir-LAQ/viewform) for course review 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

*The courses listed below are the top five most popular choices to fulfill this requirement, please use the link above to see the full list of pre-approved options.

80-180	Introduction to Linguistics	9
80-101	Dangerous Ideas in Science and Society	9
79-281	Introduction to Religion	9
57-209	The Beatles	9
84-328	Military Strategy and Doctrine	9

E. Nontechnical Elective 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. Up to 36 units of these nontechnical elective units may be filled by transfer credit (with prior approval through the MCS transfer credit process).

NONTECHNICAL ELECTIVE COURSES

Units

*The courses listed below are the top five most popular choices to fulfill this requirement.

70-101	Business Strategy Fundamentals	9
70-106	Business Science	9
70-415	Introduction to Entrepreneurship	9
70-104	Business Leadership Endeavor I	3
Up to 18 units of AP/IB/Cambridge exam credit for nontechnical courses.		9-12

Notes:

1. Courses counted toward the Cultural/Global Understanding requirement and the First-Year Writing requirement **do not** count toward this requirement.
2. Courses from DC, CFA, and Tepper on the Deletions list (<https://docs.google.com/spreadsheets/d/17OXQbjtRnburqx570pudYQ7j2YDNP3ntFVH7s1DT5T0/edit?gid=115228351#gid=115228351>) that may NOT be used to satisfy this requirement because they are too technical in nature, plus a list of courses in other colleges (including SCS, CIT, and Heinz College) that DO satisfy this requirement and are listed on the Additions list (<https://docs.google.com/spreadsheets/d/17OXQbjtRnburqx570pudYQ7j2YDNP3ntFVH7s1DT5T0/edit?gid=0#gid=0>).
3. Mix and match nontechnical courses with less than 9 units either from an approved college (as specified above) or the A (<https://www.cmu.edu/mcs/academics/undergrad/advising/course-planning/nontechnical-breadth-requirements/additions>) list (<https://www.cmu.edu/mcs/undergrad/advising/https://docs.google.com/spreadsheets/d/17OXQbjtRnburqx570pudYQ7j2YDNP3ntFVH7s1DT5T0/edit?gid=0#gid=0hss-finearts/additions.html>) as long as the combined total is at least 36 units.

The following requirements apply to all MCS bachelor's degrees:

1. Students must complete a minimum of 360 units.
2. The four courses required for the Technical Breadth category can be completed at Carnegie Mellon or via transfer credit.
3. AP/IB/Cambridge exam credit cannot be used to fulfill the Science and Society Requirement. Transfer courses will also be considered for this category.
4. AP/IB/Cambridge exam credit cannot be used to fulfill the Cultural/Global Requirement. Cultural and global understanding courses that are taken while studying abroad can be used to satisfy this requirement. In addition, transfer courses will also be considered for this category.
5. For the Nontechnical Electives requirement, students must complete a minimum of four courses totaling at least 36 units with a maximum of 18 units from AP/IB/Cambridge exam credit. In addition, transfer courses will also be considered for this category.

Double Counting Restrictions

Double counting occurs when a student attempts to use one course to meet more than one major, college, or university degree requirement. Any student attempting to double count a course should only do so in close consultation with all relevant academic advisor(s) and/or the Assistant Dean for Educational Initiatives to ensure that all degree requirements are appropriately met.

Generally speaking, students are permitted to double count courses from the MCS Core Education requirements towards their primary major, additional major, or additional minor requirements. However, the following information describes limitations to double counting policies within the MCS Core Education requirements themselves.

The goals of the MCS core technical breadth requirements are different from the goals of the non-technical breadth requirements. Therefore, students are not permitted to double count courses across the following categories/courses:

1. Technical Breadth Requirements (students must take 4 courses total, 1 each from the life sciences, physical sciences, and math, statistics and computer science).
2. Non-Technical Breadth Requirements (including the first-year seminar, first-year writing requirement, ENGAGE courses, third year seminar, cultural/global understanding requirement, and non-technical breadth requirements).

Furthermore, students are not permitted to double count courses across the following list of non-technical core requirements.

1. First-Year Writing Requirement
2. Global/Cultural Understanding Requirement
3. Science and Society Requirement
4. Non-Technical Breadth Requirements (36 units total)