School of Computer Science

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Location: GHC 4115

www.cs.cmu.edu/undergraduate-programs (http://www.cs.cmu.edu/ undergraduate-programs/)

Carnegie Mellon founded one of the first Computer Science departments in the world in 1965. As research and teaching in computing grew at a tremendous pace at Carnegie Mellon, the university formed the School of Computer Science (SCS) at the end of 1988. Carnegie Mellon was one of the first universities to elevate Computer Science into its own academic college at the same level as the Mellon College of Science and the College of Engineering. Today, SCS consists of seven departments and institutes, including the Computer Science Department that started it all, along with the Ray and Stephanie Lane Computational Biology Department, the Human-Computer Interaction Institute, the Language Technologies Institute, the Machine Learning Department, the Robotics Institute and the Software and Societal Systems Department (formerly the Institute for Software Research). Together, these units make SCS a world leader in research and education. Over the last seven years, SCS has launched four new primary undergraduate majors in Computational Biology, Artificial Intelligence (the first of its kind in the United States), Human-Computer Interaction, and Robotics. These new majors, along with the highly-ranked Computer Science major, give students in SCS distinct paths in the field of computing with ample opportunities in industry and advanced research.

The School of Computer Science offers the following majors and minors:

- B.S. in Artificial Intelligence
- B.S. in Computational Biology
- B.S. in Computer Science
- B.S. in Human-Computer Interaction
- B.S. in Robotics
- Bachelor's in Computer Science and Art (joint with the College of Fine Arts)
- Additional major in Artificial Intelligence
- Additional major in Computational Biology
- · Additional major in Computer Science
- Additional major in Human-Computer Interaction (Interdisciplinary)
- Additional major in Robotics
- Minor in Artificial Intelligence
- Minor in Computational Biology
- Minor in Computer Science
- Minor in Human-Computer Interaction
- · Minor in Information Security, Privacy and Policy
- Minor in Language Technologies
- · Minor in Machine Learning
- Minor in Neural Computation
- · Minor in Robotics
- Minor in Software Engineering

Information for these majors and minors can be found through the navigation menu or through the links below:

- Artificial Intelligence (http://coursecatalog.web.cmu.edu/schoolscolleges/schoolofcomputerscience/artificialintelligence/) (B.S. degree, additional major, minor)
- Computational Biology (http://coursecatalog.web.cmu.edu/schoolscolleges/schoolofcomputerscience/undergraduatecomputatonalbiology/) (B.S. degree, additional major, minor)
- Computer Science (http://coursecatalog.web.cmu.edu/schools-colleges/ schoolofcomputerscience/undergraduatecomputerscience/) (B.S. degree, additional major, minor)
- Human-Computer Interaction (http://coursecatalog.web.cmu.edu/ schools-colleges/schoolofcomputerscience/ humancomputerinteractionprogram/) (B.S. degree, additional interdisciplinary major, minor)
- Robotics (http://coursecatalog.web.cmu.edu/schools-colleges/ schoolofcomputerscience/robotics/) (B.S. degree, additional major, minor)

 SCS additional majors and minors (http://coursecatalog.web.cmu.edu/ schools-colleges/schoolofcomputerscience/addlmajorsminors/)

Students who apply to, and are directly admitted into, the School of Computer Science can choose between five primary majors: Arificial Intelligence, Computational Biology, Computer Science, Human-Computer Interaction and Robotics. Students with artistic and computing interests may be given the option to pursue a major in Computer Science and Art. Suitably prepared students from other Carnegie Mellon colleges are eligible to apply for internal transfer to the School of Computer Science and will be considered for transfer if grades in specific requirements are sufficiently high and space is available. Consult the program websites for specific requirements for transfer requests. Computation-oriented programs are also available within the Mellon College of Science, the Dietrich College of Humanities and Social Sciences, the College of Engineering and the College

Policies & Procedures

Academic Standards and Actions

Grading Practices

Grades given to record academic performance in SCS are detailed under Grading Practices at Undergraduate Academic Regulations (http://coursecatalog.web.cmu.edu/aboutcmu/ undergraduateacademicregulations/).

Dean's List WITH HIGH HONORS

SCS recognizes each semester those undergraduates who have earned outstanding academic records by naming them to the Dean's List with High Honors. The criterion for such recognition is a semester quality point average of at least 3.75 while completing a minimum of 36 factorable units and earning no incomplete grades.

Academic Actions

To maintain good academic standing, students from SCS must attain a quality point average (QPA) of at least 2.0 for each semester and a cumulative QPA of 2.0 and maintain adequate progress toward completing their degree requirements. For students with incomplete grade(s), default grade(s) will be used in the QPA calculation. For SCS, adequate progress toward completing degree requirements includes passing foundational courses of 15-112, 15-122, 15-151 (or 21-127 if applicable), with grades of C or higher, 21-120 and 21-122 with grades of D or higher by the end of the sophomore year. [updated: 22 Nov 24]. A review of a student's academic record is completed after each Fall and Spring semester.

A student will no longer be in good standing if they meet any of the following criteria:

- Their semester QPA is below 2.00.
- Their cumulative QPA is below 2.00.
- They fail to complete a required foundational CS or math course after two or more attempts with a C or higher. These courses include: 15-112, 15-122, 15-151 (or 21-127), 21-120, 21-122.
- They do not complete their required foundational CS and math requirements by the end of the sophomore year.

Students who are not in good standing are first put on Academic Warning for the following semester. After that following semester, if the student is still not in good standing, the student will be put on Academic Suspension. However, a student on Academic Warning who is meeting the semester QPA requirement but is not yet meeting other requirements may be continued on Academic Warning. If the QPA is impacted by an incomplete grade, the action will be reviewed once the final grade is posted, and the action will be rescinded if appropriate.

A student is removed from Academic Warning and returned to good academic standing when both the semester and cumulative quality point averages are at least 2.0, and if adequate progress toward completing degree requirements is being made (i.e. completing foundational courses).

The minimum period of Academic Suspension is one academic year (two non-summer semesters). Academic suspension is meant to allow a student to take a pause from their academic studies to address the issues that are causing poor academic performance. At the end of that period a student may return to campus (on Final Academic Warning) by:

- 1. completing a Return from Leave form from the HUB and submitting this form to their academic advisor, and
- submitting an additional written statement to their academic advisor and the SCS Associate Dean for Undergraduate Programs, minimum one page, that outlines what the student did while on leave to address the issues that led to the suspension and that would indicate future success on return, and
- (optional) submitting up to two letters of support from individuals supporting the student's return to the academic advisor and the SCS Associate Dean for Undergraduate Programs.

Upon review by the student's academic advisor and the Associate Dean for Undergraduate Programs, in consultation with the Office of Student Affairs and the Office of International Education as appropriate, the student may be approved to continue their studies.

SCS students who return from Academic Suspension will be placed on Final Academic Warning for up to 2 semesters to allow them to return to good academic standing or transfer to another major that is more suitable to their interests and abilities. Students who return to good standing after a return from suspension will be removed from Final Academic Warning. Students who return to good standing after suspension but then do not meet one or more conditions as outlined above will return to Final Academic Warning.

Students who fail to return to good academic standing after two semesters on Final Academic Warning will be dropped from the School of Computer Science. Students who have been dropped and are not admitted to another program at the university are required to absent themselves from the campus (including residence halls and Greek houses) within a maximum of two days after the action.

Students may appeal an academic warning, suspension or drop decision in writing within 10 business days of notification. Students should consult with their academic advisor before appealing, and should typically only appeal if they believe that an academic action was not correctly determined by the above criteria or if they have substantial additional information which was not available when the academic action was decided and which indicates a timely return to good academic standing. Instructions on the appeal process are given in the warning, suspension or drop letter that is sent to the student.

Leave of Absence and Return from Leave of Absence

SCS undergraduate students may elect to take a leave of absence for a variety of reasons, after consultation with their academic advisor. Students who wish to take a leave of absence must do so by the last day of classes before final exams begin and before final grades are posted (in case this is earlier). Students requesting a leave of absence must complete a form from the HUB and have this signed by their academic advisor and SCS Associate Dean for Undergraduate Programs. Students who take a leave of absence up to the last day to drop classes will have all of their classes dropped. Students who take a leave of absence after the last day to drop classes will be assigned a grade of W (withdrawa)) for all of their classes.

Students returning from a leave of absence are required to submit a Return from Leave of Absence form to their academic advisor for approval by the student's academic advisor and the SCS Associate Dean for Undergraduate Programs. In addition, for students taking a leave for academic performance reasons, the student must also supply a letter that explains the reason for the leave, the actions that were performed during the leave to prepare the student for a successful return, and a description of the on-campus resources, if required, that would be used by the student in order to increase the likelihood of success. Students returning from a leave are also encouraged to provide up to two letters of support from people close to the student (e.g. family, friends, clergy, teachers, coaches, others as appropriate). Requests to return are reviewed by the student's academic advisor, the Associate Dean and the Student Affairs liaison to determine eligibility and any resources that need to be put into place to assist the student upon return. Contact the SCS Undergraduate Office (GHC 4115) for more information.

Internal Transfer within SCS

First year students admitted to SCS are considered undeclared during their first year. These students declare their SCS major in the middle of the second semester of their first year of study. SCS students who wish to transfer from one SCS major to another SCS major may do so by applying for transfer by mid-semester break during the semester the transfer is

desired (or the end of the summer session for summer transfers). These students should consult with their academic advisor and the program director of the intended major for more information about specific course requirements and academic plans. Internal SCS transfers do not have any grade requirements. Transfers are approved based on demonstrated interest, ability, and available space in the intended major. Consult the website for the individual SCS major for more information about expected courses to take to demonstrate interest and ability. The transfer request form is available on the SCS website.

Transfer into SCS / Dual-Degree

Undergraduate students admitted to colleges at CMU other than SCS and wishing to transfer to SCS or pursue a dual degree in SCS should consult with the Director or Program Coordinator of the desired SCS major during their first year. See the individual program pages for the names of the current directors and program coordinators, along with their contact information.

- For the Artificial Intelligence primary major, students must complete 15-122, 15-150, 15-281, 10-315, one of 15-210, 15-213 or 15-251, and one of 36-225, 21-325, 36-218 or 15-259, with an expected overall QPA over these six courses of 3.6 or higher.and an overall QPA of at least 3.0, in order to be considered for transfer or dual degree.
- For the Computational Biology primary major, students must complete 21-127 (or equivalent), 15-122, 15-251, 15-351 (or 15-210*), 03-121 and either 02-251 or 02-250 with an expected overall QPA over these six courses of 3.6 or higher and an overall QPA of at least 3.0, in order to be considered for transfer or dual degree. (*Students who take 15-210 will need to also take 15-150; this course is not required for the B.S. in Computational Biology but can count as an elective.)
- For the Computer Science primary major, students must complete 21-127 (or equivalent), 15-122, 15-150, 15-210, 15-213, 15-251 with an expected overall QPA over these six courses of 3.6 or higher and an overall QPA of at least 3.0, in order to be considered for transfer or dual degree.
- For the Human-Computer Interaction primary major, students must complete 21-127 (or equivalent), 15-122, 15-150, 05-410, one of 15-210 or 15-213, and one of 05-470 or 05-651, with an expected overall QPA over these six courses of 3.6 or higher and an overall QPA of at least 3.0, in order to be considered for transfer or dual degree.
- For the Robotics primary major, students must complete 21-127 (or equivalent), 15-122, 15-213, 15-251, one of the following robotics courses: 16-211, 16-299, 16-311 (or Robot Building when launched), and one of 36-225, 21-325, 36-218 or 15-259, with an expected overall QPA over these 6 courses of 3.6 or higher and an overall QPA of at least 3.0, in order to be considered for transfer or dual degree.

Students may apply for transfer by the start of the mid-semester break in the semester when the final course(s) of the six required courses will be completed (or the end of the summer session for summer transfer requests). In the case of course(s) in progress, the mid-semester grades will be used in the QPA calculation. The decision to allow transfer or dual degree will be made by committee based on the student's academic performance (in the specified courses and in their courses overall if necessary), additional involvement in SCS and other computing-related activities, and availability of space in the student's class level. Students should consult the SCS Undergraduate Office for complete information concerning minimum requirements, instructions and deadlines.

External Transfer

A student currently enrolled at another university or college who wishes to transfer to SCS should first apply through the Office of Admission. If the Office of Admission believes the applicant meets admission guidelines, the student's record is sent to SCS for evaluation. Admission is based on seat availability, overall academic performance and course rigor from the student's current institution, ability to complete the rigorous SCS program on time, and the application material including recommendations and reflection essay(s). It is important to note that extremely few external transfers are admitted to the SCS program at Carnegie Mellon University due to space limitations.

Graduation Requirements

- A requirement for graduation is the completion of the program specified for a degree with a cumulative quality point average of 2.00 or higher for all courses taken at CMU.
- 2. Students must be recommended for a degree by the faculty of SCS.
- 3. A candidate for the bachelor's degree must complete at the University a minimum of four semesters of full-time study, or the equivalent of part-time study, comprising at least 180 units of course work.
- Students will be required to have met all financial obligations to the university before being awarded a degree.

General Education Requirements

All undergraduate degrees in the School of Computer Science include depth in their particular field of study but also breadth through the general education requirements. General education requirements are part of SCS degrees to give students an opportunity to learn more about the world from scientific and humanistic points of view. These additional skills are useful for graduates since computing is often embedded in domains that are not entirely within the bounds of computing. SCS students will need to use their computing skills to solve problems alongside scientists and engineers, artists, social and cognitive scientists, historians, linguists, economists and business experts, and SCS students will need to communicate effectively and understand the ethical implications of their work. The general education requirements help SCS students gain this broad perspective so they can work well in a wide variety of domains.

Science and Engineering

All candidates for a B.S. degree in the School of Computer Science must complete a minimum of 36 units offered by the Mellon College of Science and/or the College of Engineering (CIT). This includes at least four courses in science and engineering, 9 units or more for each course, where at least one course must have a laboratory component and at least two courses must be from the same department. Consult with your SCS undergraduate advisor for possible use of any mini course for this requirement which needs to be reviewed by your advisor and the SCS Associate Dean for Undergraduate Programs.

For Computational Biology majors, consult the Computational Biology (http://coursecatalog.web.cmu.edu/schools-colleges/ schoolofcomputerscience/undergraduatecomputatonalbiology/) program page for specific science and engineering requirements. The required science and engineering courses for the Computational Biology major also satisfy the General Education requirement for SCS by default. For other SCS majors, consult the lists given below for approved courses.

Non-lab courses that satisfy this requirement are given in the list below. (Consult your academic advisor for additional choices available each semester.)

03-121	Modern Biology	9
or 03-151	Honors Modern Biology	
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
03-140	Ecology and Environmental Science	9
03-161	Molecules to Mind	9
06-100	Introduction to Chemical Engineering	12
06-223	Chemical Engineering Thermodynamics	12
06-261	Fluid Mechanics	9
09-105	Introduction to Modern Chemistry I	10
09-106	Modern Chemistry II	10
09-217	Organic Chemistry I	9
09-218	Organic Chemistry II	9
09-225	Climate Change: Chemistry, Physics and Planetary Science	9
09-348	Inorganic Chemistry	10
12-100	Exploring CEE: Infrastructure and Environment in a Changing World	12
12-201	Geology	9
12-212	Statics	9
12-231	Solid Mechanics	9
12-351	Environmental Engineering	9

18-095	Getting Started in Electronics: An Experiential	9
18-100	Introduction to Electrical and Computer	12
18-220	Electronic Devices and Analog Circuits	12
18-240	Structure and Design of Digital Systems	12
24-101	Fundamentals of Mechanical Engineering	12
24-221	Thermodynamics	10
24-231	Fluid Mechanics	10
24-292	Renewable Energy Engineering	9
24-358	Culinary Mechanics	9
24-381	Environmental Systems on a Changing Planet	12
27-215	Thermodynamics of Materials	12
33-114	Physics of Musical Sound	9
33-120	Science and Science Fiction	9
33-121	Physics I for Science Students	12
or 33-141	Physics I for Engineering Students	
or 33-151	Matter and Interactions I	
33-142	Physics II for Engineering and Physics Students	12
or 33-152	Matter and Interactions II	
33-211	Physics III: Modern Essentials	10
33-224	Stars Galaxies and the Universe	9
33-225	Quantum Physics and Structure of Matter	9
33-226	Physics of Energy	9
42-101	Introduction to Biomedical Engineering	12
12 101	(can be paired with a course in Biology 03-xxx for two courses in one department)	12
42-202	Physiology (can be paired with a course in Biology 03-xxx for two courses in one department)	9
85-219	Foundations of Brain and Behavior (can be paired with a course in Biology 03-xxx for two courses in one department)	9
At present, cou	urses meeting the lab requirement include:	
02-261	Quantitative Cell and Molecular Biology	9
	(can be paired with a course in Biology 03-xxx for two courses in one department)	
02-262	Computation and Biology Integrated Research	Var.
02 202	Lab (can be paired with a course in Biology 03-xxx	, and
	for two courses in one department)	
03-124	Modern Biology Laboratory	9
09-101	(This 3 unit lab together with 09-105 satisfies the lab requirement.)	3
09-221	Laboratory I: Introduction to Chemical Analysis	12
27-100	Engineering the Materials of the Future	12
33-104	Experimental Physics	9
33-228	Electronics I	10
42-203	Biomedical Engineering Laboratory	9
85-310	Research Methods in Cognitive Psychology	9
85-314	Cognitive Neuroscience Research Methods	9
The following I and Engineerir exceptions and	CS and CIT courses cannot be used to satisfy the Scien og requirement (see note below this list for additional d conditions):	ıce
03-511	Computational Molecular Biology and Genomics	٩
04-330	Fundamentals of Software Development and Problem Solving	12

04-330	Fundamentals of Software Development and Problem Solving	12
06-262	Mathematical Methods of Chemical Engineering	12
09-103	Atoms, Molecules and Chemical Change	9
09-108	The Illusion and Magic of Food	6
09-109	Kitchen Chemistry Sessions	3
09-110	The Design and Making of Skin and Hair Products	3
09-114	Basics of Food Science	3
09-204	Professional Communication Skills in Chemistry	3
09-209	Kitchen Chemistry Sessions	3
09-231	Mathematical Methods for Chemists	9
12-215	Introduction to Professional Writing in CEE	9

12-271	Computation and Data Science for Civil & Environmental Engineering	9
18-090	Twisted Signals: Multimedia Processing for the Arts	10
18-200	ECE Sophomore Seminar	1
18-202	Mathematical Foundations of Electrical Engineering	12
18-213	Introduction to Computer Systems	12
18-330	Introduction to Computer Security	12
18-334	Network Security	12
18-335	Secure Software Systems	12
18-411	Computational Techniques for Data Science and Engineering	12
18-441	Computer Networks	12
18-460	Optimization	12
18-461	Introduction to Machine Learning for Engineers	12
18-462	Principles and Engineering Applications of Al	12
18-465	Advanced Probability & Statistics for Engineers	12
18-482	Telecommunications Technology and Policy for the Internet Age	12
18-487	Introduction to Computer Security	12
18-540	Rapid Prototyping of Computer Systems	12
19-101	Introduction to Engineering and Public Policy	12
19-211	Ethics and Policy Issues in Computing (or 17-200)	9
19-213	The American Railroad: Decline and Renaissance in the Age of Deregulation	6
19-301	Decision Making Methods for Engineers and Scientists	9
19-303	Cryptocurrencies, Blockchains and Applications	9
19-351	Applied Methods for Technology-Policy Analysis	9
19-402	Telecommunications Technology and Policy for the Internet Age	12
19-403	Policies of Wireless Systems	12
19-411	Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech	9
19-421	Emerging Energy Policies	9
19-425	Sustainable Energy for the Developing World	9
19-433	Data Science for Technology, Innovation and Policy	9
19-534	Usable Privacy and Security	9
19-608	Privacy Policy, Law, and Technology	12
24-281	Introduction to Scientific Computing	2
24-311	Numerical Methods	10
27-410	Computational Techniques in Engineering	12
33-100	Basic Experimental Physics	6
33-115	Physics for Future Presidents	9
33-124	Introduction to Astronomy	9
33-232	Mathematical Methods of Physics	10
42-201	Professional Issues in Biomedical Engineering	3
49-300	Integrated Product Conceptualization	12

All Electrical and Computer Engineering graduate courses [18-6xx, 18-7xx, 18-8xx, 18-9xx] <u>cannot</u> be used for this requirement. Students interested in Engineering & Public Policy (19-xxx) courses that are not excluded above, including special topics courses, must consult with their SCS undergraduate advisor and the SCS Associate Dean for Undergraduate Programs to determine suitability for this requirement. In general, any MCS or CIT courses that are cross-listed with SCS courses or have significant mathematical or computational content **cannot** be used for this requirement. Students must consult with an SCS undergraduate advisor about any course to be used for the Science and Engineering requirement before registration.

Humanities and Arts

All candidates for a B.S. degree in the School of Computer Science must complete a minimum of 63 units offered by the College of Humanities & Social Sciences and/or the College of Fine Arts as prescribed below. Students pursuing a Bachelor's in Computer Science and Art (http:// coursectatlog.web.cmu.edu/intercollegeprograms/bxaintercollege/

#bcsacurriculumtext) should consult the general education requirements for that program.

A. Freshman Writing Requirement (9 units)

Complete one	of the following writing options for 9 units:		
76-101	Interpretation and Argument	9	
76-102	Advanced First Year Writing: Special Topics (by invitation only)	9	
or two of these three writing minis for 9 units total:			
76-106	Writing about Literature, Art and Culture	4.5	
76-107	Writing about Data	4.5	
76-108	Writing about Public Problems	4.5	

B. Breadth Requirement (minimum 27 units: 9 units each)

Complete three courses, one each from Category 1, Category 2, and Category 3. Students may use two minis totaling 9 units or more to satisfy one of the categories, with permission of the Associate Dean for Undergraduate Education, if the minis meet the goals of the desired category. **NOTE: Artificial Intelligence majors replace Category 1** with Category 1A: Cognitive Studies which is a subset of Category 1.

Category 1 (for all SCS majors except Artificial Intelligence): Cognition, Choice and Behavior - this requirement explores the process of thinking, decision making, and behavior in the context of the individual.

70-311	Organizational Behavior	9
70-318	Managing Effective Work Teams	9
70-385	Consumer Behavior	9
80-101	Dangerous Ideas in Science and Society	9
80-130	Introduction to Ethics	9
80-150	Nature of Reason	9
80-180	Nature of Language: An Introduction to Linguistics	9
80-221	Philosophy of Social Science	9
80-252	Kant	9
80-270	Problems of Mind and Body: Meaning and Doing	9
80-271	Mind and Body: The Objective and the Subjective	9
80-275	Metaphysics	9
80-330	Ethical Theory	9
85-102	Introduction to Psychology	9
85-104	Psychopathology	9
85-211	Cognitive Psychology	9
85-213	Human Information Processing and Artificial Intelligence	9
85-221	Principles of Child Development	9
85-241	Social Psychology	9
85-251	Personality	9
85-261	Psychopathology	9
85-370	Perception	9
85-408	Visual Cognition	9
85-414	Cognitive Neuropsychology	9
85-421	Language and Thought	9
88-120	Reason, Passion and Cognition	9
88-230	Human Intelligence and Human Stupidity	9
88-231	Thinking in Person vs. Thinking Online	9

Category 1A (for Artificial Intelligence majors): Cognitive Studies - this requirement explores how the brain and the mind work.

85-211	Cognitive Psychology	9
85-213	Human Information Processing and Artificial Intelligence	9
85-370	Perception	9
85-408	Visual Cognition	9
85-421	Language and Thought	9

Category 2 (all SCS majors): Economic, Political and Social Institutions - this requirement explores the processes by which institutions organize individual preferences and actions into collective outcomes.

19-101	Introduction to Engineering and Public Policy	12
36-303	Sampling, Survey and Society	9
66-221	Topics of Law: Introduction to Intellectual Property Law	9
70-332	Business, Society and Ethics	9

73-102	Principles of Microeconomics	9
73-103	Principles of Macroeconomics	9
73-104	Principles of Microeconomics Accelerated	9
76-425	Rhetoric, Science, and the Public Sphere	9
79-101	Making History: How to Think About the Past (and Present)	9
79-189	Democracy and History: Thinking Beyond the Self	9
79-237	Comparative Slavery	9
79-244	Women in American History	9
79-253	Imperialism and Decolonization in South Asia	9
79-275	Introduction to Global Studies	9
79-300	Controversial Topics in the History of American Public Policy	9
79-320	Women, Politics, and Protest	9
79-321	Documenting Human Rights	9
79-331	Body Politics: Women and Health in America	9
79-370	Technology in the United States	9
79-383	The History of Capitalism	9
79-391	Nations and Nationalisms in South Asia	9
79-392	Europe and the Islamic World	9
80-135	Introduction to Political Philosophy	9
80-136	Social Structure, Public Policy & Ethics	9
80-244	Environmental Ethics	9
80-245	Medical Ethics	9
80-324	Philosophy of Economics	9
80-335	Social and Political Philosophy	9
80-334	Social and Political Philosophy	9
80-348	Health, Human Rights, and International Development	9
84-104	Decision Processes in American Political Institutions	9
84-110	The Economics of Politics, Policy, and Technology	9
84-275	Comparative Politics	9
84-322	Nonviolent Conflict and Revolution	9
84-324	The Future of Democracy	9
84-352	Representation and Voting Rights	9
84-362	Diplomacy and Statecraft	9
84-365	The Politics of Fake News and Misinformation	9
84-380	US Grand Strategy	9
84-386	The Privatization of Force	9
84-387	Remote Systems and the Cyber Domain in Conflict	9
84-389	Terrorism and Insurgency	9
84-390	Social Media, Technology, and Conflict	9
84-393	Legislative Decision Making: US Congress	9
84-402	Judicial Politics and Behavior	9
84-405	The Future of Warfare	9
88-281	Topics in Law: 1st Amendment	9
88-284	Topics of Law: The Bill of Rights	9
Category 3 (all	SCS majors): Cultural Analysis - this requirement	

seeks to recog to shape the h usually either l	nize cultures that have shaped and continue uman experience; courses in this category are broad in place, time, or cultural diversity.	
48-240	History of World Architecture, I	9
48-241	History of Modern Architecture	9
57-173	Survey of Western Music History	9
60-105	Cultural History of the Visual Arts	9
60-106	Cultural History of the Visual Arts - the Modern Period	9
62-371	Photography, The First 100 Years, 1839-1939	9
70-342	Managing Across Cultures	9
70-348	Cross-Cultural Business Communications	9
76-221	Books You Should Have Read By Now	9
76-230	Literature & Culture in the 19th Century	9
76-232	Introduction to Black Literature	9
76-239	Introduction to Film Studies	9
76-241	Introduction to Gender Studies	9
76-339	Topics in Film and Media	9

76-386	Language & Culture	9
79-104	Global Histories	9
79-145	Genocide and Weapons of Mass Destruction	9
79-201	Introduction to Anthropology	9
79-202	Flesh and Spirit: Early Modern Europe, 1400-1750	9
79-211	Modern Southeast Asia: Colonialism, Capitalism, and Cultural Exchange	9
79-223	Mexico: From the Aztec Empire to the Drug War	9
79-226	African History: Earliest Times to 1780	9
79-229	The Origins of the Palestinian-Israeli Conflict, 1880-1948	9
79-230	The Arab-Israeli Conflict and Peace Process Through 1948 to Present	9
79-234	Technology and Society	9
79-240	Development of American Culture	9
79-242	African American History: Reconstruction to the Present	9
79-245	Capitalism and Individualism in American Culture	9
79-248	U.S. Constitution & the Presidency	9
79-261	The Last Emperors: Chinese History and Society, 1600-1900	9
79-262	Modern China: From the Birth of Mao to Now	9
79-265	Russian History: Game of Thrones	9
79-281	Introduction to Religion	9
79-282	Europe and the World Since 1800	9
79-288	Bananas, Baseball, and Borders: Latin America and the United States	9
79-293	Inward Odyssey	9
79-316	Photography, the First 100 Years, 1839-1939	9
79-329	LGBTQ+ History	9
79-345	Roots of Rock & Roll	9
79-350	Early Christianity	9
/9-3/8	Gender in South Asia	9
79-393	Institutions of the Roman Church	9
79-395	The Arts in Pittsburgh	9
79-396	Music, Art, and Society in 19th and 20th Century Europe and the U.S.	9
79-465	I ne Arts in Qatar	9
80-100	Introduction to Philosophy	9
00-250	Ancient Philosophy Medern Bhilosophy	9
00-251	Continental Philosophy	9
80.254	Analytic Philosophy	9
80.255	Pragmaticm: Making Idoas Work	9
80.261	Experience Reason and Truth	9
80-276	Philosophy of Religion	9
82-119	Arabic Calligraphy Culture & Skills	9
82-267	Revond the Mafia and Michelangelo	9
82-273	Introduction to Japanese Language and Culture	9
82-279	Anime - Visual Interplay between Japan and the World	9
82-280	Billingual & Bicultural Experiences in the US	9
82-282	Interpreting Global Texts & Cultures	9
82-283	Language Diversity & Cultural Identity	9
82-286	Of Minorities and Migrants: Exploring Germany from the Margins Germany Today	9
82-293	Russian Cinema: From the Bolshevik Revolution to Putin's Russia	9
82-294	19th Century Russian Masterpieces	9
82-303	French & Francophone Cultures	9
82-304	French & Francophone Sociolinguistics	9
82-313	Topics in Modern Arabic Language, Literature and Culture	9
82-314	Literature of the Arabic-speaking World	9
82-327	The Emergence of the German Speaking World	9
82-333	Introduction to Chinese Language and Culture	9
82-342	Spain: Language and Culture	9
82-343	Latin America Language and Culture	9
82-344	U.S. Latine Cultures	9

82-345	Using Spanish in Social Contexts	9
82-436	Introduction to Classical Chinese	9

C. Humanities and Arts Electives (minimum 27 units)

Complete 3 non-technical courses of at least 9 units each from any of the departments in the Dietrich College of Humanities & Social Sciences or the College of Fine Arts. Some of the courses taught in these units are considered technical courses and may not be used to satisfy this requirement (see Deletions below). Additionally, a select set of courses from Business Administration and from Environmental and Public Policy can also count for this requirement (see Additions below). Students may combine humanities/arts courses with lower units together to form a single course of 9 units or more with advisor approval in consultation with the SCS Associate Dean for Undergraduate Programs. Students are encouraged, but not required, to take courses from different departments to gain additional breadth and to create new opportunities for engagement with the university community.

Deletions

Some courses from the Dietrich College or the College of Fine Arts may <u>not</u> count toward the unconstrained electives in Humanities and Arts in SCS due to the technical (computing and/or mathematical) nature of the courses. Courses from the following departments do not count toward the unconstrained Humanities and Arts electives:

- Statistics and Data Science (36), except 36-303 Sampling, Survey and Society
- Information Systems (67)
- Economics (73), except 73-102 Principles of Microeconomics, 73-103 Principles of Macroeconomics, 73-104 Principles of Microeconomics Accelerated, and 73-369 Islamic Economics.

Additionally, the following courses do NOT count toward the unconstrained Humanities and Arts electives:

51-257	Introduction to Computing for Creative Practices	10
51-327	Design Center: Introduction to Web Design	9
51-328	Design Center: Design for Digital Systems	9
76-388	Coding for Humanists	9
76-481	Introduction to Multimedia Design	12
76-487	Information Architecture & Content Strategy	9
80-210	Logic and Proofs	9
80-211	Logic and Mathematical Inquiry	9
80-212	Arguments and Logical Analysis	9
80-305	Game Theory	9
80-306	Decision Theory	9
80-310	Formal Logic	9
80-311	Undecidability and Incompleteness	9
80-315	Logics for Knowledge and Belief	9
80-316	Logic and AI	9
80-325	Foundations of Causation and Machine Learning	9
80-411	Proof Theory	9
80-413	Category Theory	9
80-419	Interactive Theorem Proving	9
80-514	Categorical Logic	9
80-521	Seminar on Formal Epistemology: Belief and Evidence	Var.
85-219	Foundations of Brain and Behavior	9
85-310	Research Methods in Cognitive Psychology	9
85-314	Cognitive Neuroscience Research Methods	9
85-414	Cognitive Neuropsychology	9
85-426	Learning in Humans and Machines	9
88-251	Empirical Research Methods	9
88-372	Social and Emotional Brain	9

Additions

The following courses outside of Dietrich College and the College of Fine Arts may count toward the unconstrained Humanities and Arts electives:

07-135	Grand Challenge First-Year Seminar: Designing Better Human-Al Futures	9
11-423	ConLanging: Lrng. Ling. & Lang Tech via Constru Artif. Lang.	12
16-161	ROB Seminar: Artificial Intelligence and Humanity	12
16-397	Art, Conflict and Technology	12
17-333	Privacy Policy, Law, and Technology	9

17-202	Law of Computer Technology	9
19-101	Introduction to Engineering and Public Policy	12
19-351	Applied Methods for Technology-Policy Analysis	9
19-402	Telecommunications Technology and Policy for the Internet Age	12
19-403	Policies of Wireless Systems	12
19-411	Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech	9
21-150	Mathematics and the Arts	9
32-201	Leadership & Management	9
32-402	Leadership and Ethics	9
70-100	Global Business	9
70-311	Organizational Behavior	9
70-318	Managing Effective Work Teams	9
70-321	Negotiation and Conflict Resolution	9
70-332	Business, Society and Ethics	9
70-340	Business Communications	9
70-341	Team Dynamics and Leadership	9
70-342	Managing Across Cultures	9
70-345	Business Presentations	9
70-348	Cross-Cultural Business Communications	9
70-350	Acting for Business	9
70-352	Business Acting	3
70-364	Business Law	6
70-365	International Trade and International Law	9
70-381	Marketing I	9
70-430	International Management	9
70-443	Digital Marketing and Social Media Strategy	9

Honors Research Thesis

Students considering going on to graduate school in Computer Science or related disciplines should take a wide variety of Computer Science and Mathematics courses, as well as consider getting involved in independent research as early as possible. This would be no later than the junior year and can begin even earlier. Students interested in graduate school in computer science or its related areas are strongly encouraged to participate in the SCS Honors Undergraduate Research Thesis program. Additionally, graduate CS courses can be taken with permission of the instructor and in consultation with an academic advisor.

The goal of the SCS Honors Undergraduate Research Thesis Program is to introduce students to the breadth of tasks involved in independent research, including library work, problem formulation, experimentation, analysis, technical writing and public speaking. In particular, students write a short paper summarizing prior results and current progress in their desired area of research, present a public poster session in December of their senior year describing their current progress, present their final results with a poster and an oral presentation in the year-end university-wide Undergraduate Research Symposium (Meeting of the Minds) and submit a written thesis at the end of their senior year. Students work closely with faculty research advisors to plan and carry out their research. The 07-599 SCS Honors Undergraduate Research Thesis typically starts in the fall semester of the senior year, and spans the entire senior year. Students receive a total of 36 units of academic credit for the thesis work, 18 units per semester. Students should prepare their research prospectus (i.e. proposal of work) during the spring semester of their junior year, and students in this program are advised to plan their schedules carefully to ensure there is ample time to perform the required research for the thesis during the senior year.

Students interested in research are urged to consult with their undergraduate advisor and the SCS Associate Dean for Undergraduate Programs no later than the end of their sophomore year in order to plan their workload effectively. Although there is no specific QPA requirement to participate, students are expected to have at least a 3.5 QPA in the core SCS topics relevant to their proposed research to be successful in their work. For those students with no background in research, they may consider using 07-300 Research and Innovation in Computer Science (9 units) as an introduction to the research process in their junior year since this course will introduce students to various research projects going on in the School of Computer Science and important skills that are needed to be an effective researcher. This course leads to a subsequent research practicum, 07-400 Research Practicum in Computer Science (12 units), that allows students to complete a small-scale research study or experiment and present a research poster. Students who use this practicum to start their senior thesis can use the 12 units toward the required 36 units. Students should consult with their academic advisor concerning how the units earned toward the senior thesis can be used toward elective requirements for their major.

Interested juniors should submit a project prospectus of 3-4 pages by the end of their junior year, although submissions over the summer prior to the senior year will also be considered for review. A prospectus must include:

- · The name of the research advisor (an SCS faculty member)
- A short abstract (two paragraphs, max)
- · A description of the problem to be worked on and its significance
- A tactical description of the proposed research plan, including:
 - a description of the background reading to be carried out,
 - · a description of the research contribution,
 - a description of the expected results of the research, and
 - a reasonably detailed timeline for the thesis work
- A bibliography of related work (all references belong here)
- The signature of the research advisor, signifying endorsement of the project and willingness to supervise and evaluate it (or an email confirmation from the research advisor)

Students who need help finding potential advisors should get in touch with their academic advisor or the Associate Dean for Undergraduate Programs. Applications to the program are due by the start of the senior year, although submission of applications in the junior year is encouraged.

Students completing an outstanding senior thesis based on the judgement of the SCS Undergraduate Review Committee will earn SCS College Honors and can compete for various SCS research awards given out during commencement.

Faculty

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