

CATALOGUE 2010-11

**HARVEY MUDD COLLEGE
CATALOGUE
2010–11**

HARVEY MUDD COLLEGE seeks the nation's brightest men and women to prepare them for leadership roles in an increasingly complex world. The College graduates engineers well-trained in the sciences, scientists with a knowledge of engineering, and mathematicians familiar with both science and engineering. The College emphasizes the humanities and social sciences so that its graduates will understand the impact of their work on society.

“Technology divorced from humanity is worse than no technology at all.”
—HMC Founding Trustees

STATUS OF CATALOGUE

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The official version of the Harvey Mudd College Catalogue is updated yearly and resides on the World Wide Web. See www.hmc.edu/catalogue/index.html. Consult the College website (www.hmc.edu) for further information about the College.

ACCREDITATION

Harvey Mudd College is accredited by the Western Association of Schools and Colleges (WASC), 985 Atlantic Avenue, Suite 100, Alameda, CA 94501, 510.748.9001. Their website is www.wascweb.org/senior/.

The Harvey Mudd College Engineering Program is accredited by ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202, 410. 347.7700.

STATEMENT ON NONDISCRIMINATION

Harvey Mudd College does not discriminate on the basis of race, color, sex (gender or gender identity), sexual orientation, age, marital status, religion, disability, national origin, ethnic origin or prior military service in any of its policies, procedures and practices, including admission policies, educational policies, scholarship and loan programs, employment policies and other College-administered programs and activities. This statement is in compliance with Title IX of the Educational Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, and other requirements of federal and state law. Harvey Mudd College's Human Resources Director is responsible for coordinating the College's nondiscrimination effort. Inquiries or complaints concerning the application of Title IX, Section 504, or any other equal opportunity legal requirements of this institution should be referred to the Director of Human Resources.

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INTRODUCTION

Since 1957, Harvey Mudd College has sought high-ability students with the potential to develop thoughtful and creative solutions to the world's challenging problems. Those who attend HMC learn that technology divorced from humanity is worse than no technology at all. They commit to intellectual honesty. They learn humility. And they leave with a broad scientific and technological perspective that is applicable to many professions.

UNDERGRADUATE FOCUS

The opportunities offered by HMC's exclusive undergraduate focus give the College's students access to some of the top undergraduate engineering, science and mathematics faculty in the country. More than 95 percent of all faculty (full-time, part-time and instructors) hold a Ph.D., and courses taught by graduate students are extremely rare. Students enjoy a faculty dedicated to their education. They study and work in facilities that are comparable to what graduate students enjoy at research universities. Students at Harvey Mudd College learn both theory and practice. All students conduct research or do engineering design; all have the opportunity to work on the real-world problems of corporate and not-for-profit clients through the College's Clinic Program. These opportunities for hands-on learning give Harvey Mudd College graduates an advantage that has resulted in a high placement rate of its job-seeking graduates. HMC is also an outstanding setting in which to prepare for an advanced degree.

Additionally, Harvey Mudd College recognizes the importance of preparing its graduates to live and work in a multicultural world. Students have the opportunity to participate in a community that values diversity and promotes cultural competence. The social environment is also shaped by an Honor Code that sets a tone of trust and collaboration and minimizes the intense competition that is often the by-product of bringing together exceptionally accomplished individuals.

HISTORICAL OVERVIEW

Harvey Mudd College was founded in 1955 and began operations in the fall of 1957, less than one month before Sputnik I launched the Space Age, making technical education a priority in the United States. Forty-eight students and seven faculty were the pioneers who shaped this unique, highly selective institution born of the generosity of businessman and philanthropist Harvey S. Mudd and the vision of Joseph B. Platt, the nuclear physicist who served as the College's first president. Harvey Mudd College became the fifth autonomous member of a much larger center of learning, The Claremont Colleges, an affiliation that broadens both academic and social opportunities for its students.

COLLEGE MISSION

HMC's founders had a good basic idea, one that had gone untried. This "good basic idea" has been expressed a dozen different ways, but the simplest is the College's mission statement:

Harvey Mudd College seeks to educate engineers, scientists and mathematicians well versed in all of these areas and in the humanities and social sciences so that they may assume leadership in their fields with a clear understanding of the impact of their work on society.

Harvey Mudd College pioneered—and put into practice—the idea of relating human needs to engineering and science education. It was able to do so because, as a new institution, it had no particular tradition to uphold or other barriers to innovation. And the school's innovation and spirit of educational adventure—qualities that attract superior people—appealed to new faculty, staff and students. Ever since its founding, the College's faculty has been made

up of top-flight professionals—humanists who are not dissuaded by technology, and engineers and scientists who have an abiding faith in liberal learning.

DEDICATED FACULTY

All of Harvey Mudd College's full-time faculty (about 80) have Ph.D.s or a terminal degree in their field of study, and all are engaged in research. Each faculty member's focus, however, is teaching the approximately 770 students at the College. For the College as a whole, upper-division classes and laboratory sections average between 10 and 15 students. Faculty-student interaction is particularly good as students take advantage of the extensive research and design opportunities.

A PROVEN CURRICULUM

In the beginning, the courses and curriculum of Harvey Mudd College were formulated under a grant from the Carnegie Corporation, and featured a rigorous Core designed to graduate engineers, scientists and mathematicians with grounding in all of these fields as well as an understanding of their social context. This Core is still at the heart of the modern curriculum that fully integrates the humanities and social sciences. While the original Core has been modified on occasion throughout the years since 1957, the founders' vision for a broad foundation for future work continues to be a hallmark of an HMC education and is reflected in the most recent Core revision, implemented in Fall 2010. Now, as at the institution's inception, all Harvey Mudd College students receive general education in the humanities, social sciences and the arts (more than a quarter of all course work, more courses, in fact, than at any engineering College in the country) and basic work in biology, computer science, chemistry, engineering, mathematics and physics—the departmental major programs that the College offers. Students may also design individual programs of study outside of these majors, or major in an area of study offered at one of the other Claremont Colleges.

GRADUATE SUCCESS

The curriculum developed by Harvey Mudd College is effective—the proof is in the College's graduates. About three out of four eventually enter graduate schools, most in the top graduate programs in their fields, be it at Harvard, Johns Hopkins, MIT, Caltech, Yale, Stanford, Berkeley or other prestigious graduate schools. Eventually, most graduates go to work in industry, typically for firms such as Boeing, ESRI, Fair Isaac, Microsoft, Northrop-Grumman, and Raytheon. HMC graduates far more than its share of leaders in the pure and applied sciences. Within five years of graduation, alumni have usually reached such jobs as project engineer, research scientist and systems engineer. Those out more than five years are more likely to be chief engineers, division managers, senior scientists or even vice-presidents or general managers. An increasing number are entrepreneurs and are founding their own companies—some while still in school.

Many Harvey Mudd College alumni with advanced degrees work for “think tanks” or industrial research centers like RAND, the Aerospace Corporation, Bell Laboratories, IBM's Watson Research Center, the Jet Propulsion Laboratory, Lawrence Berkeley National Laboratory and NASA. Others are on the faculties of Yale, MIT, the University of California (Berkeley, Davis, Los Angeles, San Diego, Santa Cruz), Columbia University, the University of Washington, Dartmouth, Purdue, Claremont McKenna College and Harvey Mudd College—not all teach engineering, mathematics and science. Included among our graduates are doctors in small towns and at research hospitals like the Mayo Clinic, artists, vintners, entrepreneurs, economists, historians, philosophers, oceanographers, actuaries, and even a few astronauts. The bottom line is that Harvey Mudd College graduates are able to seek out satisfying places for themselves in a wide variety of fields.

HOME TO TOP STUDENTS

The Harvey Mudd College student body of approximately 770 students come from many different places and backgrounds, but they are alike in one way: They have a deep dedication to engineering, science and mathematics and are also interested in the role of these fields in society. More than that, they are good in these fields, and they like to be around others who share their interests. They spend a great deal of time in classrooms and laboratories, in conference with faculty members, and in study—and like most of their work. They make time to participate in college and community life through volunteer service work, student government, or student publications. They compete on athletic teams or participate in club sports. They enjoy going to concerts, art exhibits and parties. Many play musical instruments and participate in Claremont Colleges performance groups. They are involved and engaged students who are intellectually gifted with a strong ability in engineering, science and mathematics.

CAMPUS FACILITIES

The Harvey Mudd College campus is a pleasant combination of beauty and efficiency. The buildings—residence halls, dining hall, classrooms, office buildings, laboratories and athletic center—are of a single, carefully planned architectural design, and the grounds have many tree-shaded paths, grassy slopes, flower beds, patios and plazas. Of course, the vast central facilities of The Claremont Colleges are open to everyone at Harvey Mudd College.

The Harvey Mudd College campus includes:

Residence Halls—Living accommodations for students are provided in eight residence halls: Mildred Mudd, West, North, Marks, Atwood, Case, Linde and Sontag. North Hall and Mildred Mudd Hall constitute the Seeley W. Mudd Memorial Quadrangle. Marks, Atwood, Case, Linde, and Sontag Halls are named in honor of David X. Marks, J.L. Atwood, Florence H. and Gerald R. Case, Ronald and Maxine Linde, and Frederick ('64) and Susan Sontag, respectively.

Joseph B. Platt Campus Center—This two-story building was named for the founding president. The Campus Center houses many student services, including the Dean of Students, Residential Life, Student Emotional Health, Student Activities, the Registrar, Academic Affairs, Career Services, Study Abroad, Institutional Diversity, and Facilities and Maintenance. The facility also includes a mailroom, lounges, music practice rooms, Jay's Place (a late-night dining and gathering place in memory of Jay Wolkin '99), a game room, offices for student organizations and the Green Room, a large meeting area.

Hoch-Shanahan Dining Commons—Completed in 2005, this dining facility, certified under LEED (Leadership in Energy and Environmental Design) guidelines, can hold 466 diners. It is home to the Aviation Room, which celebrates the College's former Bates Aeronautics Program and its graduates, and has a number of meeting rooms and patio areas. The building was named for trustees Richmond J. Hoch '63 and his wife, Diane, and R. Michael Shanahan and his wife, Mary.

The Norman F. Sprague Memorial Building—The building houses a digital Learning Studio on the first floor that includes classroom space with flexible furniture and laptops, a large area for individual and group work with desktop computers and lounge seating, as well as a group work area. The offices of the Dean of Faculty are on the fourth floor, and work spaces for the Computer Science and Mathematics Departments are located on the second and third floors, respectively. The building was a gift of Dr. and Mrs. Norman F. Sprague Jr. in memory of Dr. Sprague's father.

The Parsons Engineering Building—Named in honor of Ralph M. Parsons, this three-story building houses the Department of Engineering, the Engineering Clinic, the Department of Humanities, Social Sciences and the Arts, and the Office of Computing and Information Services.

The F.W. Olin Science Center—A gift of the F.W. Olin Foundation, this three-story building, completed in 1992, houses the Departments of Biology, Computer Science, and Mathematics, instructional facilities, and research and teaching labs.

The Jacobs Science Center—A gift of Dr. and Mrs. Joseph J. Jacobs, this three-story building houses offices and laboratories for the Departments of Chemistry and Physics.

W.M. Keck Laboratories—A four-story building developed with a gift from the W.M. Keck Foundation, this facility houses a portion of the Departments of Chemistry and Physics, classrooms and laboratories.

Beckman Hall—Built with a gift from the Arnold and Mabel Beckman Foundation, this facility houses classrooms, laboratories, computer facilities for the computer science, mathematics, biology and other departments, and a 75-seat auditorium.

Galileo Hall—This facility is a combination of a lecture/demonstration hall and workshops. It contains a concourse of workshops for the fabrication of instructional and research apparatus. The facility was named for the Galileo Society, now called the Legacy Society.

Hixon Court—In front of Galileo Hall is a stunning European fountain and koi pond, a gift from the Alexander Hixon family.

Linde Activities Center—The Linde Activities Center provides a central recreation area for the Harvey Mudd College community. It houses a full-length basketball court with six retractable hoops and is also suitable for volleyball, badminton and special events. The center also has a computing lab, an aerobics workout area, a fitness area with a full range of conditioning equipment, shower and locker facilities, a lounge area equipped with a big-screen television, and two large multipurpose rooms.

INFORMATION TECHNOLOGY

Harvey Mudd College provides extensive computing resources to the campus community; the Computing and Information Services Department (CIS) is responsible for many of them. The department provides many services as well as opportunities for students to get involved in developing the College's computing infrastructure.

CIS manages many aspects of computing at Harvey Mudd College, including:

- The Learning Studio in Sprague
- The Linde Activities Center (LAC) labs
- An equipment loan program (laptops, tablets, projectors)
- Networked printers throughout the College
- The wireless network
- Help Desk (Parsons B142, Monday through Friday, 7:30 a.m. to 5 p.m.)

For details about these and other services, please visit the CIS website (www.hmc.edu/about/administrativeoffices/cis.html).

The Help Desk is students' first point of contact for all CIS services; and the staff can assist with hardware and software installation, configuration, troubleshooting, repair or advice. Students may drop by or contact the Help Desk via e-mail helpdesk@hmc.edu or via phone at 909.607.7777.

Students at The Claremont Colleges abide by the Claremont-wide acceptable use policy. Use of HMC information technology resources constitutes acceptance of this policy.

CENTRAL TO MOUNTAINS, OCEANS, DESERTS

The College is in Claremont, about 35 miles east of Los Angeles, in a suburban area that was once broad stretches of citrus groves. It is at the foot of Mount San Antonio (Mount Baldy), the highest peak in the San Gabriel Range—10,064 feet.

Claremont's population of about 34,000 live in well-tended homes on tree-covered streets. Freeways provide easy access to desert wilderness areas, Pacific Ocean beaches, the local mountains (snow-covered in the wintertime), Colorado River country, Pasadena (home of the Rose Parade), Disneyland, Knott's Berry Farm, San Diego and its wilderness and marine parks, Los Angeles and the many attractions of Hollywood—all within a two-hour drive.

THE CLAREMONT COLLEGES

From the beginning, Harvey Mudd College drew great strength from its membership in The Claremont Colleges, currently five small, independent colleges and two graduate institutions. They are—in order of founding—Pomona College (1887), The Claremont Graduate University (1925), Scripps College (1926), Claremont McKenna College (1946), Harvey Mudd College (1955), Pitzer College (1963) and the Keck Graduate Institute of Applied Life Sciences (1997).

Each of the five undergraduate colleges has a four-year academic program leading to its own bachelor's degree. Each has its own campus, its own students and faculty, and its own distinctive style. Yet the campuses adjoin, and the colleges open their courses to one another's students and cooperate in sponsoring joint academic and extracurricular programs. Together, they provide students with facilities and services comparable only to a top-flight university.

With a combination of over 6,500 students and about 600 faculty members, the colleges generate an endless variety of intellectual, cultural, and social activities. Guest speakers, symposia and conferences are frequent, and there are numerous concerts, art exhibits, film series and theater productions.

The assets of The Claremont Colleges total more than \$4.8 billion, including substantial endowments in all of the colleges, over 175 buildings, and 550 acres of land—320 now occupied and 230 reserved for colleges and professional schools that may be founded in the future.

Pomona College, founded in 1887, is an independent, coeducational liberal arts college with approximately 1,550 students. It offers 45 majors in the humanities, natural sciences, social sciences and fine arts, leading to the bachelor of arts degree. The founding member of The Claremont Colleges, Pomona makes a number of its programs and facilities available to all Claremont students. The Pomona College Theatre and Dance Department offers instruction and performance opportunities to interested students from all the campuses. The Pomona College Symphony Orchestra and other instrumental and choral ensembles also invite other Claremont Colleges students to audition. Oldenborg Center for Modern Languages and International Relations, in addition to sponsoring a wide array of intercultural events, provides a setting for daily foreign language practice at language lunch tables. The Pomona College Museum of Art mounts temporary and student exhibitions for The Claremont Colleges community.

Claremont Graduate University (CGU) (1925) awards master's and doctoral degrees in 25 academic and professional fields. It has about 2,050 students and a core faculty of approximately 88, supplemented by more than 200 faculty from the undergraduate Claremont Colleges and affiliated institutions. Superior undergraduate students at The Claremont Colleges may work simultaneously toward the satisfaction of the undergraduate degree requirements and a master's degree. Applicants must be recommended by their respective colleges and usually enter the program at the beginning of their junior year or later. Interested students should consult their advisors as early as possible, preferably during their sophomore

or junior years, to plan their academic programs. Claremont Graduate University is authorized to recommend candidates to the California Commission on Teacher Credentialing for public school teaching multiple or single-subject clear credentials with cross-cultural, language, and academic development (CLAD) emphasis in most recognized teaching areas. Interested students should contact the director of teacher education at the graduate university for specific information early in their undergraduate careers.

Scripps College was founded in 1926 by newspaper publisher, educator and philanthropist Ellen Browning Scripps as one of the few institutions in the West dedicated to educating women for professional careers, as well as personal intellectual growth. While many colleges are now coeducational, Scripps continues as a women's college because it believes that having women at the core of its concerns provides the very best environment for intellectually ambitious women to learn from a distinguished teaching faculty and from each other. Scripps' four-year liberal arts curriculum emphasizes interdisciplinary studies in the humanities, combined with rigorous training in the disciplines as the foundation for careers in the professions, the arts, business, science, government, and the academia, as well as for fulfilling private lives.

Claremont McKenna College (CMC), founded in 1946, is a coeducational residential liberal arts college with an enrollment of about 1,200. The college educates students for responsible leadership in business, government and the professions within the context of a liberal arts curriculum that emphasizes economics and government. With 11 on-campus research institutes, CMC provides faculty and students the opportunity to study issues ranging from leadership to international relations to environmental management.

Pitzer College, founded in 1963, is a coeducational, undergraduate, liberal arts college that blends classroom instruction with fieldwork and engages a student's mind, heart and spirit by integrating educational resources on campus, abroad and in the local community. Pitzer offers a curriculum that spans more than 40 majors and focuses on interdisciplinary, intercultural education with an emphasis on social responsibility and community service.

Keck Graduate Institute of Applied Life Sciences (KGI), established in 1997, provides a professional degree program for scientists and engineers and recent college graduates with science and engineering degrees wishing to pursue business leadership roles in the bioscience industry. This two-year program includes rigorous interdisciplinary coursework, a capstone team project and an industrial internship. The curriculum interweaves the study of systems biology, computer science and bioengineering with instruction in organizational structure, finance, management and business ethics. Upon successful completion of the program, KGI confers the master of bioscience degree. KGI is an independent, coeducational institution, and was the first American graduate school dedicated exclusively to the applied life sciences.

RESOURCES OF THE CLAREMONT COLLEGES

As one of The Claremont Colleges, Harvey Mudd College shares the use of many facilities and services, of which the library is perhaps the most notable.

The Claremont Colleges Library provides vast resources that include well over two million volumes. The Library partners with The Claremont Colleges in learning, teaching, and research. Committed to fostering intellectual discovery, critical thinking, and life-long learning, the Library ties the academic community to varied cultural and scholarly traditions by offering user-centered services, building collections, developing innovative technologies, and providing an inviting environment for study, collaboration and reflection.

Honnold/Mudd Library holds collections in the humanities, sciences and social sciences. Honnold/Mudd has been a selective depository for United States Government publications since 1913. Its holdings include publications issued by the State of California, the United Nations, other international agencies and Great Britain. Also in Honnold/Mudd, the Asian Studies Collection includes over 80,000 items, most in Chinese, Japanese and Korean languages. The CUC Records Center, located at 2038 W. 11th Street in Upland, houses paper

journals and a small percentage of books from the library collections. Materials at the Records Center may be requested for delivery or may be browsed on site.

Librarians and staff provide assistance with locating and using both traditional and electronic information sources. Librarians teach students how to find, evaluate and effectively use information and offer research assistance via e-mail and instant messaging. Research instruction for classes and other groups, as well as individual appointments for instruction and research assistance, may be scheduled.

The Library's large collection of electronic resources provides ready access to a wide variety of bibliographic, full-text and multimedia information. Via the Internet, it is possible to search Blais, the online catalog, or any of hundreds of databases including services such as Lexis-Nexis Academic and ISI Web of Science. Full-text resources include electronic books and journals, as well as specialized resources such as the ACM Digital Library, Congressional Quarterly Library and Grove's Dictionary of Art Online. The Claremont Colleges Digital Library (CCDL) provides access to a growing number of digital collections from the colleges as well as from the library's Special Collections. Digital collections such as Early English Books Online and North American Women's Letters & Diaries make available thousands of additional primary source materials. Most of these resources are accessible via the Internet to students, faculty and staff of The Claremont Colleges.

The Library has many special collections. Some of the most distinctive are the Oxford Collection, the Bodman Collection (history and literature of the Italian Renaissance), the Philbrick Library (drama and theater history), the Westergaard and Bjork Collections (Scandinavia and the Baltic area), and the McCutchan Collection (American hymnology). Students in history may do research in the Macpherson Collection (by and about women), the William Smith Mason Collection (Western Americana), the Wagner Collection of History and Cartography of the North Pacific, the William McPherson Collection of Western Americana, and the Hanna Collection (Western Americana). Local history collections include materials on water resources in Southern California and The Claremont Colleges Archives. For students in the sciences, the Hoover Collection contains rare volumes on the history of science and the metallic arts assembled by President Herbert Hoover and his wife, Lou Henry, and the Woodford Collection includes rare and historical geology books.

Students also have access to several nearby affiliated libraries, including Denison Library on the Scripps College campus; the George C. Stone Center for Children's Books, a division of Claremont Graduate University's Center for Developmental Studies in Education; the botanical and horticultural library of the Rancho Santa Ana Botanic Garden; and the library at the Claremont School of Theology.

In addition, The Claremont Colleges support:

Tranquada Student Services Center, headquarters for the student health services of the Colleges. The building also includes Health Education Outreach and the Monsour Counseling and Psychological Services, with a staff of full-time psychologists trained to facilitate the development of human skills and competencies.

The Robert J. Bernard Biological Field Station, encompassing 86 acres of land near the campuses. It contains parcels in various stages of ecological succession and serves as a natural outdoor laboratory for many disciplines.

McAlister Center for Religious Activities, a nonsectarian meeting place for students and faculty as well as a place of worship.

Huntley Bookstore is the source for all course-required textbooks and support materials used at The Claremont Colleges. The bookstore carries many academic trade and reference titles, new releases, bestsellers, academic study aids, school and office supplies, emblematic clothing and gift items as well as magazines, snacks and soft drinks. Huntley Computer Sales provides both Apple and PC hardware and software at academic pricing as well as a selection of computer supplies, peripherals and repair services.

Table Mountain Observatory, is located one hour from campus, at an altitude of 7,200 feet and is owned by Pomona College. The site is on the opposite side of the San Gabriel Mountains from Claremont, shielded from the lights of Los Angeles. At the site, The Claremont Colleges jointly operate a 1.0-meter Cassegrain telescope, the largest undergraduate telescope in the country, which is available for use by qualified Harvey Mudd College students. The equipment available to students for classes and astronomical research includes two optical CCD imaging cameras, a near-infrared array camera, and a stellar spectrograph, all of which are interfaced to modern computers. Data analysis is done on campus in the Astronomical Imaging Laboratory.

Other educational resources of the colleges include the Intercollegiate Women's Studies Program, the Intercollegiate Departments of Africana and Chicano Studies, the Offices of Black and Chicano/Latino Student Affairs, the Claremont School of Theology, the Rancho Santa Ana Botanic Garden, the Blaisdell Institute for Advanced Study in World Cultures and Religion, the Institute for Antiquity and Christianity, and the California Institute of Public Affairs.

HARVEY S. MUDD, 1888–1955



A mining engineer, Harvey S. Mudd (1888-1955) was a graduate of Stanford and Columbia Universities. He served with distinction as president of the American Institute of Mining and Metallurgical Engineers. With his father, he founded and later became president of Cyprus Mines Corp., whose Los Angeles-based international enterprises started with the development of the copper mines on the island of Cyprus.

Harvey Mudd was a director of the Southern Pacific Company, of the Texas Gulf Sulphur Company, and of the Founders Fire and Marine Insurance Company. He was a founding director of the RAND Corporation. He was a trustee of the California Institute of Technology, a director of the Hospital of the Good Samaritan, and a trustee of the Southwest Museum. He was president of the Southern California Symphony Association for 12 years and chairman of its board for nine years.

He had a particular interest in The Claremont Colleges and served as chairman of the Board of Fellows of Claremont College—now the Claremont Graduate University and the Claremont University Consortium—for a quarter of a century. While serving in that position, he helped plan for the undergraduate liberal arts college of engineering, science and mathematics that was chartered in 1955, shortly after his death.

STUDENT LIFE

HONOR SYSTEM

The Honor System, established and operated by the students, sets the fundamental principles of conduct for members of the College. It applies to all academic matters such as examinations, written material and laboratory reports—both at Harvey Mudd College and at the other Claremont Colleges—and to the safety of individuals, and private and College property.

STANDARDS OF CONDUCT

When students enter Harvey Mudd College, it is assumed that they have an earnest purpose. Students are expected to act as responsible individuals, to conduct themselves with honesty and integrity both personally and academically, and to respect the rights of others. The College considers these standards to be essential to its academic mission and its community life.

In this context, the College is an inclusive community of faculty, students and staff. Those who make up the community have participated in developing the standards and the policies that they believe will support the primary purpose of the educational community and the personal development of the individual students.

Unbecoming behavior or violations of College policies or procedures are referred to the student Judiciary Board or the Disciplinary Board for action. These authorities may impose penalties of varying degrees of severity, including expulsion from the College. Students should be aware of federal regulations that require all colleges to implement programs to prevent illicit drug and alcohol use and alcohol abuse by students and employees. It is the policy of HMC to abide by these regulations. Violations may incur legal and College sanctions.

Students are expected to know and abide by all College policies, regulations and procedures, and to report any violations of these.

NEW STUDENT ORIENTATION

The program of orientation, which begins prior to the opening of classes each fall, includes transition-to-college-life programming, social events, placement examinations and academic orientation. All new students are expected to attend.

SCHEDULE

Since most courses meet three times a week and the normal academic program is five courses, most students spend three to five hours in class each day except Saturday and Sunday. In addition, most laboratory periods are scheduled in the afternoons. Most students do approximately three hours of academic work outside of class for every hour they spend in class (not including laboratories). Students should consult with their academic advisors to devise a realistic schedule that provides adequate time for study, extracurricular and social activity.

HOUSING FACILITIES

There are eight residence halls. All first-year students are required to live on campus. Single rooms, doubles and suites for three or more are available. Lounges in each building afford additional space for meetings and social activities.

DINING FACILITIES

Students may eat at HMC's Hoch-Shanahan Dining Commons or at any of the other dining halls of the undergraduate Claremont Colleges. In addition to standard cafeteria meals, each meal plan provides a weekly allocation of "Board Plus" dollars for food purchases at campus retail sites.

SOCIAL LIFE

The social life of a student at Harvey Mudd College may be as active as the student wants. The Claremont Colleges' Calendar includes at least one concert every month, outside speakers almost daily, a dozen art exhibits a year, frequent theater presentations, two distinct athletic programs (CMC-HMC-Scripps and Pomona-Pitzer), cinema series, intramurals and many other events. Student-led committees sponsor a myriad of activities for the student body, including trips to Los Angeles for sporting and theater events, movies, amusement parks and museums; beach trips; camping and hiking trips; campus parties; dances; and more.

THE DEAN OF STUDENTS OFFICE

The Dean of Students' staff assist students in all aspects of their college lives. Off-campus recreational and cultural activities are planned in conjunction with student organizations. The campus life program, led by the Dean of Campus Life, operates cooperatively with residence hall presidents. Emotional health support is offered by a licensed clinical social worker, who serves as Associate Dean. These, and many other services, are designed to support students as they mature personally and academically.

STUDENT COUNSELING

All members of the Dean of Students Office staff, the Associate Dean for Academic Affairs, and members of the faculty and staff are readily available to help individual students with academic, career and personal questions. The Associate Dean for Student Health and Wellness provides crisis intervention and brief counseling for students needing support while enrolled. The Associate Dean works closely with The Claremont Colleges' Monsour Counseling and Psychological Services that provide, without charge, the services of full-time psychologists. The service offers personal counseling, and all matters are confidential. Members of the staff also lead personal growth groups on topics such as psychological fitness, human sexuality, and relaxation and stress management.

STUDENT HEALTH

The Claremont Colleges maintain a fully-equipped health center with physicians and nurse practitioners in attendance. Medical advice and care are available to students in the colleges, with certain reasonable limitations. (See General Regulations, page 109, for details.)

OFFICE OF THE REGISTRAR

The Office of the Registrar provides information about the academic schedules and records of students, present and past. The office also processes classroom scheduling, class enrollment, major changes, advisor changes, degree audits, grades, Dean's List notation, enrollment verifications, transcript requests and degree verifications. In cooperation with the other four undergraduate colleges in The Claremont Colleges Consortium, the office produces the Undergraduate Schedule of Courses each semester.

CAREER SERVICES

The Office of Career Services provides resources to assist students in making informed career decisions. Throughout the academic year, workshops are conducted on resume writing, interviewing, networking, negotiating and researching. On-campus recruiting occurs bi-annually during Career Fairs that typically attract over 60 companies to campus. Various specialized nights are held during the academic year, including National Labs Night. All events are advertised to students on the Web and via e-mail. The Career Resource Library includes periodicals, how-to books, directories and industry-specific books; a database of companies provides additional resources for students. Individual career counseling is also available.

WRITING CENTER

The Harvey Mudd College Writing Center offers an arena where students can work through the writing process and improve the expression of their ideas by participating in workshops and individual conferences with trained peer consultants. Student writers of all skill levels and disciplines are able to work with student consultants, who offer feedback and encouragement during any stage of the writing process, from developing an idea to polishing a final draft. Peer consultants are also trained to help students with graduate school and fellowship essays, resumes and cover letters. The Writing Center is open five evenings a week throughout the academic year. In addition to individual conferences and topical group workshops, the center offers a variety of print and electronic resources for writers.

OFFICE OF INSTITUTIONAL DIVERSITY

The Office of Institutional Diversity (OID) serves as the hub of diversity training, information, consulting and programming for the HMC community, as well as partners with a wide variety of HMC departments and 5-C units to design, implement and evaluate diversity activities. OID also provides direction and advice to its partners to insure that diversity goals and objectives are obtained. The office coordinates and facilitates a wide range of diversity programs and educational activities for HMC students, staff and faculty. Such programs include:

- Asian Heritage Month
- Black History Month
- OID Book Club
- GAYpril Events
- Friday Forum
- OID Movie Series
- Women's History Month
- Cinco de Mayo

OID maintains a comprehensive library of diversity resources (movies, videos, documentaries, books, magazines) which is available to the entire HMC community on an honor-system basis, provides on-going advising, mentoring and counseling to underrepresented students at HMC, and serves as a supplementary advisor to the following student organizations:

- Asian-Pacific Islander-Support Program at Mudd (API-SPAM)
- People Respecting Individuals' Sexualities at Mudd (PRISM)
- National Society of Black Engineers (NSBE)
- Society of Women Engineers (SWE)
- Society of Hispanic Professional Engineers (SHPE)

The office also hosts the Summer Institute, an intensive two-and-a-half-week summer residential experience that offers new students an early introduction to HMC.

ROTC

Students interested in pursuing a commission in the United States Air Force concurrently with obtaining a degree may do so by enrolling in Air Force Reserve Officer Training Corps (AFROTC). Through a joint agreement with the University of Southern California, Harvey Mudd College offers AFROTC to the students of The Claremont Colleges and other four-year institutions in the local area. Additional information about Air Force ROTC, including course descriptions, scholarship opportunities and faculty contact information, can be found at the AFROTC website.

ATHLETICS AND RECREATION

Harvey Mudd College, Claremont McKenna College and Scripps College are associated in a joint program of intercollegiate athletics, intramural and recreational activities, physical education and club sports known as Claremont-Mudd-Scripps (CMS). CMS facilities include a football field, gymnasium (an aerobic fitness room, a weight room with both free weights and a Nautilus system), a soccer field, a lacrosse field, a nine-lane 400-meter track, a baseball field, a softball field, an aquatics center with a competition pool for swimming, diving and water polo, nine tennis courts, volleyball courts, and numerous intramural and recreational fields.

The intercollegiate athletic program is one of the most successful athletic programs in the country. A member of the NCAA Division III and the Southern California Intercollegiate Athletic Conference (SCIAC), which has eight members, CMS sponsors 21 intercollegiate sports for men (the “Stags”) and women (the “Athenas”).

Students who do not participate in intercollegiate competition may join intramural teams like inner-tube water polo, flag football, volleyball, soccer, basketball, softball, golf, swimming, paintball, tennis, ultimate Frisbee and floor hockey.

Club sports of ballroom dancing, fencing, men’s lacrosse, men’s and women’s rugby, women’s field hockey, ultimate Frisbee and rowing play are additional pastimes.

An extensive list of offerings is available for physical education credit, which may be pursued even beyond the three-semester requirement.

HMC’s Linde Activities Center (LAC) is the hub of students’ recreational and fitness activities. The LAC has aerobics and weight rooms, meeting rooms, a computing lab, and basketball, badminton and volleyball courts. It is open to all HMC students and their guests.

STUDENT GOVERNMENT

The College encourages students to participate in the governing of student life through the Associated Students of Harvey Mudd College (ASHMC). Student body and class and dorm officers manage committees that plan and coordinate many extracurricular and social activities. ASHMC’s Committee for Activities Planning, composed of students, plans and promotes off-campus activities for students, ranging from concerts to rock-climbing. All students are encouraged to participate and contribute ideas for upcoming events.

OTHER ACTIVITIES

Many other activities of interest to students may be found on the Student Activities web page, www.hmc.edu/studentlife1/activities.html.

ADMISSION

APPLICANT INFORMATION

Each year, Harvey Mudd College enrolls approximately 185 new students. Admission to HMC is highly selective, and the Admission Committee has the difficult task of selecting the students who will most benefit from and contribute to the intellectual, social and residential life of the College. While admission is competitive, the committee bases its decision on a holistic review of each application; therefore, no able student who has strong interest in mathematics and science, should be discouraged from applying.

When reviewing each candidate, the committee seeks to determine how the student has taken advantage of resources available. Of particular concern are the rigor of the student's academic course load, the grades earned, and the recommendations received in support of the applicant. Taking a full program of demanding academic work every semester is very important. The Admission Committee also notes trends in grades, relative strengths and weaknesses, and overall academic preparation.

Past academic performance is one of the strongest predictors of academic success in college and thus most of the College's entrants have stood in the top 10 percent of their high school classes. The Admission Committee is especially impressed by students who have earned top grades in mathematics and science, but who also excel in the humanities, social sciences and the arts. Harvey Mudd College students also tend to have high scores on the SAT or ACT tests.

It is individual students who enter Harvey Mudd College, not grades or class ranks or test scores. Looking beyond the objective criteria, the committee assesses the student's application in a holistic manner to identify qualities that show potential, motivation, perspective, creativity, energy, originality, character, and ability to work in teams. Extensive participation or leadership within one's school or community activities; an unusual accomplishment in a scientific area; a special talent; a notable amount of resilience; any of these qualities may influence a decision favorably. The College also seeks a diverse student population and encourages applications from candidates from groups traditionally underrepresented in engineering, science and mathematics.

Because of the focus on individual strengths, there is no disadvantage for multiple candidates from the same high school. Those who have an unusual academic background (alternative programs, home-schooling, graduating early, etc.) are given equal consideration, and should consult the Office of Admission counselors to learn how to present their experiences completely and clearly.

FIRST-YEAR ADMISSION

There are three application deadlines for admission to the first-year class. The Early Decision I deadline is November 15 with notification sent by December 15. The second round of Early Decision applications has a deadline of January 2 with notifications sent by February 15. Regular Decision candidates apply by January 2, are notified by April 1 and must respond to the offer of admission by May 1. All acceptances are contingent upon satisfactory completion of the final term in good standing in all matters related to course work and character.

First-year students can apply for entrance only in the fall semester. Every candidate is responsible for ensuring that all credentials are received by the application deadline. If any questions arise about the application, the staff in the Office of Admission is available for advice and counsel to all students and their parents.

Common Application— All candidates for admission should apply using the Common Application as well as the HMC Supplement to the Common Application. Forms can be found by visiting www.commonapp.org or by using the links provided on the HMC Admission website.

Application Fee— The admission application should be accompanied by a \$60 application fee, which covers part of the cost of processing the application. It is not refundable. Students

who have unusual financial need should not be discouraged from applying, but should file their admission applications accompanied by a Fee Waiver form or a letter from the high school counselor requesting that the fee be waived.

Counselor and Teacher Recommendations— These are confidential reports by the school counselor and by classroom teachers. The secondary school report is completed by a high school counselor. A mathematics, physics, chemistry or biology teacher should complete a second recommendation. A third recommendation must be completed by an English, history or foreign language instructor. These recommendation forms are found on the common application web site: www.commonapp.org. Applicants may submit more than the required number of recommendations, if they wish, but should not make substitutions. Students should be judicious in the number of additional recommendations submitted.

Official Transcripts— Applicants must submit transcripts from high school work through the junior year. A transcript showing work completed in the first semester or first trimester of the senior year should also be sent as soon as those marks are available. Students must also file transcripts for any college courses completed. A final official transcript confirming graduation and good standing at the conclusion of the school year is also required of any enrolling student.

Standardized Tests— Every first-year applicant is required to take the College Board SAT or the ACT exam (including the writing component). All applicants are also required to take two SAT Subject Tests: Math Level 2 and a second exam of the candidate's choice. Early Decision I applicants may take the SAT or ACT Reasoning Test and/or Subject Tests as late as the November test date. Applicants for the second round of Early Decision may submit scores from tests taken as late as December. Regular Decision applicants may take the SAT tests as late as the January test date or the ACT exam as late as the December test date.

Candidates must register with the College Board or ACT, Inc. to take the tests, which are offered several times a year all over the world. The Admission Committee will only accept and review official score reports submitted by the College Board or ACT, Inc.

In evaluating the application, the Admission Committee places more weight on the student's curriculum and grades than on test scores. We will only use the highest score from any one test to put the application in the best possible light.

Score Choice— A new program offered by the College Board allows students taking the SAT to consider the option of sending only selected score reports to colleges. In contrast, *HMC's policy requires students to send all SAT and/or ACT scores.*

Personal Interview— Interviews are not required but are strongly recommended. They provide an excellent opportunity for applicants to learn more about Harvey Mudd College. They also allow a member of the admission staff to get to know an applicant better. Typically, interviews occur during the fall of, or in the summer just before, a student's senior year.

It should be noted that there is no need to postpone an interview until all credentials are on file. Simply call the Office of Admission at 909.621.8011, at least one week in advance for an appointment. The office is open weekdays throughout the year and on most Saturdays from September through November. Anyone is welcome to tour the campus.

CURRICULAR EXPECTATIONS

Applicants are expected to complete a strong program of studies in the course of their secondary school preparations. Each enrolling student is required to complete one year of high school or one semester of college course work in calculus, chemistry and physics. Students who are unable to complete any of these courses may be admitted contingent upon successful completion of a summer college course in that discipline. Applicants who will have not completed the requirements should make this fact known at the time of their applications. The Admission Committee encourages students to pursue advanced course work, especially in science and mathematics, if their preparation allows.

English– Four years. It is assumed that the student will have a thorough grounding in grammar and competence in writing and speaking.

Mathematics– Calculus is required before entering in the fall.

Laboratory Science– At least one year of chemistry and one year of physics are required before entering in the fall. One year of biology is recommended.

Foreign Language– Two years recommended.

Social Science– Applicants are encouraged to elect at least two years of social science courses, including at least one year of history.

FIRST-YEAR EARLY DECISION

First-time college candidates who decide that Harvey Mudd College is clearly their first choice may use one of the Early Decision options. Students who apply under an Early Decision plan may only have one Early Decision application currently active at any one time. This means that a student may only use the Early Decision option at HMC if other Early Decision applications to other colleges have been closed. Early Decision is a binding decision. Applicants admitted through Early Decision are expected to withdraw all other college applications, to not initiate new ones and to enroll at Harvey Mudd College. Students sign a statement along with the high school counselor verifying that all other college applications have been withdrawn. Students who are unsure about their choice for college should not use an Early Decision option, but should instead apply by the Regular Decision deadline of January 2. Early Decision candidates should submit all of their credentials by November 15 for Early Decision I or by January 2 for Early Decision II.

In considering Early Decision applicants, the Admission Committee may vote in one of three ways: it may accept the Early Decision candidate, it may postpone action, or it may deny admission. An early application is denied if the committee feels that no other decision would be possible in the spring. If a decision is postponed, applicants' chances for acceptance are not prejudiced in any way, and the application is considered along with all Regular Decision candidates. Students whose decisions are postponed are released from the agreement (obligation to enroll) that was signed in the Early Decision Statement.

Early Decision I candidates who wish to apply for financial aid must file their online College Scholarship Service (CSS)/ Financial Aid PROFILE application on or before November 15. The deadline for Early Decision II applicants is on or before January 2. Also, candidates must submit a signed copy of their parents' federal income tax return from the previous year, on or before November 15 for Early Decision, and on or before January 2 for Early Decision II. These tax forms should be sent directly to the Office of Financial Aid. Please refer to the Financial Aid section for more information. For information about applying for financial aid as an Early Decision candidate, go to <http://www.hmc.edu/edfinancialaid>.

DEFERRED ENTRANCE

Candidates who are accepted for admission may petition to delay (or defer) their entrance for a year. They should write to the Office of Admission describing their plans and must submit their commitment deposits by May 1. Once a request is approved, space is reserved for the next fall semester. Students may not enroll in a degree program at another college during this interval and they may not initiate any new applications.

INTERNATIONAL STUDENTS

The procedure for the admission of students from foreign countries is essentially the same as the procedure for domestic students. International applicants must submit all official credentials in English or with translations. In addition, international students must show that they are sufficiently fluent in English to enable them to handle the work of all courses. Harvey

Mudd College does not offer English as a Second Language or other special programs for non-English speaking foreign students.

Scores from the TOEFL (Test of English as a Foreign Language) or International English Language Testing System (IELTS) are required. The minimum score for the TOEFL examination is 600 (paper test) or 100 iBT (internet Based Test). The minimum score for the IELTS is 7. While Harvey Mudd College offers funding for some international students, financial aid for foreign students is extremely limited.

TRANSFER ADMISSION

Students are considered for transfer standing if they will have completed the equivalent of one year of full-time academic coursework by the time they enter Harvey Mudd College. Candidates must submit their applications by April 1 prior to the September of desired enrollment. Notices of the committee's decisions are mailed by May 15 and response regarding the offer of admission is required by June 10. Candidates who have applied previously to HMC should make that known when contacting the Office of Admission about transferring.

In addition to high school transcripts, two personal essays and the application fee, transfer candidates must submit transcripts from secondary school and of all previous college work, along with course descriptions of all college courses completed or in progress. At least one of the three required references must come from a mathematics, science or engineering instructor at the candidate's college. Students must present an official statement indicating that they left their previous college in good standing academically and otherwise. Transfer candidates are strongly encouraged to submit two SAT Subject Tests (Math Level 2 and another of the student's choice).

In assessing transfer applications, the Admission Committee places considerable weight on the nature and quality of the previous college record. Where college transcripts do not clearly indicate the quality of work (e.g., many pass/no credit courses), it is the applicant's responsibility to provide supplemental information to assist the committee's evaluation.

All transfer students must spend the equivalent of four full-time semesters at HMC and must complete all HMC degree requirements.

The College policy on awarding credit for work completed elsewhere is described under "Academic Regulations." Offers of admission are conditional, pending review of final transcripts showing satisfactory completion of courses in progress.

3-2 PROGRAMS

HMC offers a 3-2 Program in Economics and Engineering in cooperation with Claremont McKenna College. The program is designed for students who want a liberal arts background, with emphasis on economics and management, and an engineering major. The students spend their first three years at Claremont McKenna College studying mathematics, science, economics, management and general education courses. At the end of the junior year, they may apply as transfer students to HMC.

HMC also has a 3-2 program in Engineering with Scripps College. It is similar to the 3-2 program with Claremont McKenna College, but the 3-2 Program with Scripps College does not include the emphasis on economics. The students reside at Scripps College for their first three years and cover a broad range of courses with emphasis in mathematics and science.

Students accepted into either 3-2 program must complete HMC's requirements for general education and for the engineering major. Because curricular expectations for the 3-2 transfer program are specific, potential applicants are strongly encouraged to consult with the Harvey Mudd College Office of Admission as well as the chairperson of the Department of Engineering.

VETERANS

Candidates who are veterans of the armed services should submit a copy of their honorable discharge papers along with the other required credentials.

ADVANCED PLACEMENT

The Admission Committee recognizes that advanced placement (AP), International Baccalaureate (IB) and honors courses are often more demanding than conventional courses and gives appropriate weight to them in the selection process. HMC does not award credit for either AP or IB exams.

COURSES FOR HIGH SCHOOL STUDENTS

Local high school students may be permitted to take a small selection of HMC mathematics and science courses if such courses are not offered in their high schools. These students must have excellent academic credentials and submit a “special student application” no later than two weeks prior to the start of classes. Selection is made by the Office of Admission after reviewing the application and following consultation with the appropriate academic department(s). These students are not considered to be in residence. Charges for special course work are nominal, reflecting only the administrative processing costs, not the cost of instruction. The Office of Admission can provide details on fees for the coming year.

CAMPUS VISITS

Students and their parents are encouraged to visit Harvey Mudd College, especially when classes are in session. Tours, class visits, interviews and overnight stays are available. Please contact the Office of Admission at 909.621.8011 or visit the HMC website to arrange a visit and get directions.

RETENTION

Of the 202 students who enrolled as HMC first-year students in September 2008, 184 returned to register in September 2009 for a first-year retention rate of 91 percent. Of the 193 students who enrolled as first-year students in 2004, 167 have graduated as of May 16, 2010.

COLLEGE EXPENSES**TUITION**

The tuition charge for the 2010–2011 academic year at Harvey Mudd College is \$40,133. (Students enrolled in 10 or more units are charged full tuition. Those in less than 10 are charged pro rata.) The tuition charged is less than half the actual cost of the student’s education. The College bears the additional expense through gifts from alumni and friends. In effect, every student receives a partial scholarship. On the basis of recent experience, tuition can be expected to increase each year due to increasing costs. However, the College has been very successful in assisting students who need financial aid through its extensive program of scholarships, loans and employment opportunities.

ENROLLMENT DEPOSIT

Every admitted student who plans to enter is required to remit a non-refundable enrollment deposit of \$300 by the date prescribed in the acceptance letter. It is imperative that students planning to attend the College submit the deposit to the Office of Admission by the deadline. Confirmation of final admission is contingent upon this deposit.

ROOM AND BOARD

The 2010-2011 charge for a campus room is \$6,935. Board charges for the year are \$6,263 for 16 meals a week plus \$16 “Board Plus” per week (full board). Other board plans available are \$5,247 for 12 meals a week plus \$12 “Board Plus” per week, and \$3,758 for eight meals a week plus \$8 “Board Plus” per week. The cost of living off-campus is generally similar to on-campus charges.

DUES AND FEES

Dues set by the Associated Students of Harvey Mudd College are \$257 per year.

TOTAL EXPENSES

Listed below are the total College expenses for the 2010–2011 academic year:

Tuition	\$ 40,133
Room Rent	\$ 6,935
Board (16 meals)	\$ 6,263
Student Body Fee	\$ 257
Total	\$53,588

It is projected that overall expenses will increase between 4 and 6 percent each academic year. The College reserves the right to change these, or any other fees, at any time. Entering first-year and transfer students will be charged an additional \$100 orientation fee.

OTHER EXPENSES

Additional expenses for a year at Harvey Mudd College also include the cost of books and supplies, clothing, transportation, recreation and incidentals. The cost of books and supplies averages \$800 per year. Personal expenses will vary but are approximately \$900 per year. An allowance toward transportation expenses should be added for students outside the Southern California region only.

MONTHLY PAYMENT PLAN

Payment of all regular charges is due prior to the beginning of each semester per the due date on the Harvey Mudd College billing statement. However, annual charges may be paid in ten monthly installments. The first installment is due in July and the final installment is due the following April. Applications for the monthly payment plan are mailed to all students in June and there is a service charge of \$10 per month (\$50 per semester). Use of the monthly payment plan is a privilege that may be revoked for cause.

FINANCIAL AID

Harvey Mudd College offers a comprehensive program of scholarships, grants, loans and work from the College, the federal and state governments, and from other sources to assist students and parents in paying the cost of attending Harvey Mudd College.

The College is committed to its need-blind admission policy and guarantees that it will meet the 100 percent of the demonstrated financial need of each applicant as determined by the Free Application for Federal Student Aid (FAFSA) and the CSS/Financial Aid PROFILE applications.

Approximately 83 percent of the families with students attending Harvey Mudd College receive need-based or non-need based financial assistance in the form of scholarships, grants, work-study, and/or loan funds. Approximately 70 percent receive scholarship assistance directly from Harvey Mudd College.

One of the primary goals of the financial aid staff is to inform prospective students and parents, as well as current students and parents, of the various financial aid programs available to assist families with educational costs. For information, consult “Costs and Financial Aid” on the HMC website (www.hmc.edu) or contact the financial aid staff with questions at 909.621.8055.



ACADEMIC PROGRAM

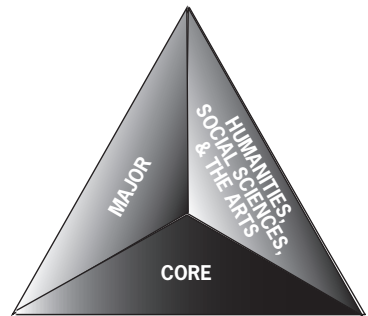
OVERVIEW

Harvey Mudd College seeks to educate engineers, scientists and mathematicians well versed in all of these areas and in the humanities and social sciences so that they may assume leadership in their fields with a clear understanding of the impact of their work on society.

The founders of Harvey Mudd College envisioned a distinctive educational experience for the College's students. The curriculum was designed to create scientists and engineers with unusual breadth in their technical education and a firm academic grounding in the humanities, social sciences and the arts.

The required curriculum, as revised by the College in January 2010, is divided into three components: the Common Core, which provides the foundation for advanced study; the program in Humanities, Social Sciences, and the Arts, which completes the liberal arts nature of a Harvey Mudd College education by providing humanistic and social scientific perspectives; and the Major, which builds depth and technical competence. Unifying all of these is an emphasis on strong oral and written communications, the development of computational skills, and direct experience with a research or design project. The academic programs are demanding, but the College fosters cooperation rather than competition under a successful Honor Code.

In order to be recommended by the faculty for the Bachelor of Science degree, students are required to complete satisfactorily a minimum of 128 credit hours of courses (including approved transfer credits for courses taken at other colleges). Students must also complete all of the requirements of each of the three curricular components as well as a physical education requirement.



COMMON CORE

The Common Core presents a coordinated, common foundation essential to the education of all students. It includes three semesters of mathematics, two and one-half semesters of physics and an associated laboratory, one and one-half semesters of chemistry and an associated laboratory, an interdisciplinary or disciplinary “choice lab” selected from a changing set of offerings, a half-semester of college writing, a course in critical inquiry offered by the Department of Humanities, Social Sciences, and the Arts, and one course each in biology, computer science and engineering.

Core courses address three objectives: (1) acquisition of disciplinary knowledge and experience with disciplinary-related techniques, (2) skill development in the areas of oral and written communication, critical thinking, teamwork and collaboration, project management and/or leadership, and (3) explorations of either the interrelationship of technical work and society or the understanding of one's own culture or other contemporary cultures.

All Core courses must be attempted by the end of the fifth semester.

The 2010–2011 academic year marks the debut of a substantial revision of the Core. All students who enter the College in the fall of 2010 will be governed by the set of requirements that appear below rather than those appearing in previous catalogues. It is the case that students have the option of graduating under any catalogue (that is, fulfilling the set of requirements represented by any catalogue) that is in effect during their continuous enrollment at the College. Students who entered the College in the fall of 2009, for example, will be able to graduate under the 2009–2010 catalogue.

Core courses, except the Choice Labs, are listed below. Course descriptions are given in the course listings for the departments. Choice Labs will be developed for the academic year 2011–12.

WRITING**1. INTRODUCTION TO ACADEMIC WRITING (1.5)**

A seminar devoted to effective writing strategies and conventions that apply across academic disciplines. The course emphasizes clarity, concision, and coherence in sentences, paragraphs, and arguments.

CHOICE LABORATORY**LAB (1)**

Laboratory course emphasizing experiential learning. (Starting 2011–12)

BIOLOGY**52. INTRODUCTION TO BIOLOGY (3)**

Topics in cell biology, molecular biology, genetics, and evolution. Prerequisites: one semester of general chemistry and one semester of calculus.

CHEMISTRY**23S. STRUCTURE (1.5)**

Molecular and electronic structure, intermolecular forces, condensed phases, organic structure and properties, and biopolymers.

23E. ENERGETICS (1.5)

Phase behavior, equations of state, intermolecular forces, thermodynamics, and electrochemistry.

23D. DYNAMICS (1.5)

Kinetics, equilibria, acid/base chemistry, and electrochemistry.

24. CHEMISTRY LABORATORY (1)

Applications of thermodynamics, equilibria, electrochemistry, structure/property relationships, synthesis, spectroscopy, and chemistry in the service of society.

COMPUTER SCIENCE**5. INTRODUCTION TO COMPUTER SCIENCE (3)**

Introduction to elements of computer science. Students learn general computational problem-solving techniques and gain experience with the design, implementation, testing and documentation of programs in a high-level language. In addition, students learn to design digital devices, understand how computers work, and learn to program a computer in its own machine language. Finally, students are exposed to ideas in computability theory. The course includes discussions of societal and ethical issues related to computer science.

ENGINEERING**59. INTRODUCTION TO ENGINEERING SYSTEMS (3)**

An introduction to the concepts of modern engineering emphasizing modeling, analysis, synthesis and design. Applications to chemical, mechanical and electrical systems. Prerequisites: sophomore standing and concurrent registration in Physics 51.

HUMANITIES, SOCIAL SCIENCES, AND THE ARTS (HSA)**10. CRITICAL INQUIRY (3)**

This course introduces students to inquiry, writing, and research in HSA, through focused exploration of a particular topic selected by the instructor in each section. To encourage reflection on the place of HSA within the HMC curriculum, the course begins with a brief unit on the history and aims of liberal arts education.

MATHEMATICS**25B/25G. CALCULUS AND LINEAR ALGEBRA (3)**

Theory and techniques of differential and integral calculus of a single real or complex variable; infinite series, including Taylor series and convergence tests. Theory and applications of vectors and matrices, including systems of linear equations; linear transformations in Euclidean space; determinants, eigenvalues, eigenvectors, and diagonalization. An introduction to multivariable calculus, including partial derivatives, double and triple integrals. The topics covered in 25B are the same as those covered in 25G, but this course digs deeper into the theory and applications of the materials. Prerequisites: Mastery of single-variable calculus. A placement test administered during Orientation will determine whether students take Mathematics 25B or 25G.

35. PROBABILITY AND STATISTICS (1.5)

Sample spaces, events, axioms for probabilities; conditional probabilities and Bayes' theorem; random variables and their distributions, discrete and continuous; expected values, means and variances; covariance and correlation; law of large numbers and central limit theorem; point and interval estimation; hypothesis testing; simple linear regression; applications to analyzing real data sets.

45. INTRODUCTION TO DIFFERENTIAL EQUATIONS (1.5)

Modeling physical systems, first-order ordinary differential equations, existence, uniqueness, and long-term behavior of solutions; bifurcations; approximate solutions; second-order ordinary differential equations and their properties, applications; first-order systems of ordinary differential equations.

60. MULTIVARIABLE CALCULUS (1.5)

Review of basic multivariable calculus; optimization and the second derivative test; higher order derivatives and Taylor approximations; line integrals; vector fields, curl, and divergence; Green's theorem, divergence theorem and Stokes' theorem, outline of proof and applications.

64A/65. DIFFERENTIAL EQUATIONS/LINEAR ALGEBRA II (1.5)

General vector spaces and linear transformations; change of basis and similarity; generalized eigenvectors; Jordan canonical forms. Applications to linear systems of ordinary differential equations, matrix exponential; Nonlinear systems of differential equations; equilibrium points and their stability. Mathematics 65 will replace Mathematics 64A in Fall 2011.

PHYSICS**22. PHYSICS LABORATORY (1)**

This course emphasizes the evidence-based approach to understanding the physical world; students design, conduct, and interpret experiments to give quantitative answers to physical questions. Topics are drawn from a broad range of physics subjects, with applications to other technical fields.

23. SPECIAL RELATIVITY (1.5)

An introduction to special relativity covering kinematics, energy, momentum, conservation laws, and applications to cosmology.

24. MECHANICS AND WAVE MOTION (3)

Kinematics, dynamics, linear and angular momentum, work and energy, harmonic motion, waves and sound.

51. ELECTROMAGNETIC THEORY AND OPTICS (3)

An introduction to electricity and magnetism leading to Maxwell's electromagnetic equations

in differential and integral form. Selected topics in classical and quantum optics. Prerequisites: Physics 23-24; corequisite, Mathematics 60, or concurrently.

COMPLETING THE COMMON CORE

For many students the academic program in the first two years consists of the Common Core, two additional humanities, social sciences, or arts courses, two courses in the major and two electives. Usually it is possible for students to delay their choice of a major until midway through the sophomore year or even to the beginning of the junior year. Students should consult their academic advisors early in their program in order to ensure that their options will remain open. After the first year, students must register for all deficient first-year courses each time they are offered. All such courses must be passed before the beginning of the junior year. Sample programs for the first two years appear below.

Sample First-Year Program

	First Semester Credit Hours	Second Semester Credit Hours
Biology 52		
Introduction to Biology		3
Chemistry 23S, 23E, 23D, 24		
Structure	1.5	
Energetics	1.5	
Dynamics		1.5
Chemistry Lab	1	
Computer Science 5		
Introduction to Computer Science	3	
Humanities, Social Sciences, and the Arts 10		
Critical Inquiry		3
Mathematics 25B/G, 35, 45		
Calculus and Linear Algebra	3	
Probability and Statistics		1.5
Introduction to Differential Equations		1.5
Physics 22, 23, 24		
Physics Lab		1
Special Relativity	1.5	
Mechanics and Wave Motion		3
Writing 1		
Introduction to Academic Writing	1.5	
Elective	3	3
Physical Education	1	
TOTAL CREDIT HOURS	17	17.5

The instructors in the first-year program meet regularly with the Associate Dean for Academic Affairs to insure that course material, major assignments and examinations are coordinated throughout the year.

Sample Sophomore Fall Program

	Credit Hours
Engineering 59	
Introduction to Engineering Systems	3
Mathematics 60, 65	
Multivariable Calculus	1.5
Differential Equations and Linear Algebra II	1.5
Physics 51	
Electromagnetic Theory and Optics	3
Various departments, Choice Lab	1
Elective	3
Humanities, Social Sciences, and the Arts course	3
Physical Education	1
TOTAL CREDIT HOURS	17

HUMANITIES, SOCIAL SCIENCES, AND THE ARTS

The program in Humanities, Social Sciences, and the Arts is one of the distinctive and defining aspects of Harvey Mudd College. From its inception, the College has regarded a strong grounding in these areas as an essential part of the education of engineers, scientists and mathematicians, who need to be mindful of the richness and complexities of the human experience as well as the social contexts and consequences of their own endeavors.

In addition to the Common Core course, students must complete 11 full semester courses (one of them in the spring semester of the first year) in a coherent program planned with the approval of their Humanities, Social Sciences and the Arts advisor. This program must include two key elements:

- a concentration of courses in a single discipline or in an interdisciplinary field chosen from the distinct areas of liberal arts study offered at The Claremont Colleges
- a distribution of courses in different disciplines that exposes students to the varieties of intellectual approaches that inform the humanities and social sciences

To foster the growth of an intellectual community, students must take at least six courses (including HSA 10) from departmental faculty members. Students may select their remaining courses from a large number available at Harvey Mudd College and the other Claremont Colleges.

For more information regarding these requirements, see the listing under Departmental Programs in this catalogue, as well as the Department of Humanities, Social Sciences, and the Arts Advising Handbook.

INTEGRATIVE EXPERIENCE

The founders of the College held that “technology divorced from humanity is worse than no technology at all.” To explore the meaning of the founders’ vision, students choose a one-semester integrative experience (IE) course that explores the interaction between science, technology and society. IE courses may be offered by any academic department, and they are frequently team-taught. The IE program is supervised by the Curriculum Committee. The Integrative Experience requirement is being phased-out as the New Core is being phased-in. Students entering in the Fall of 2010 or later will not be subject to the Integrative Experience requirement though courses flagged as Integrative Experiences will continue to be offered.

An IE course may be (1) a faculty-initiated course/experience or (2) a student initiated experience. Included in category (1) are (a) courses that include consideration of one or more issues involving the relationship of science or technology with contemporary society; (b) courses offered in parallel with Clinic or research involving groups of students in critical reflection on the ethical and social issues involved in their projects and/or prior projects; and (c) project-based courses that specifically address a societal need, in the performance of which students

substantively consider the wider set of societal issues that create the context and need for their actions. In category (2), a student-initiated experience is an independent project/experience designed by a student or a group of students that includes treatment of specific interactions between science/technology and society. Students proposing an experience must complete the online form prior to close of business on the first day of the semester. In all IE course/experiences, there should be a final paper or project with demonstrable evidence of significant self-reflection and critical analysis, and an oral presentation of the work in a forum that allows open discussion of the work in a community setting. The Curriculum Committee will be responsible for determining whether a course or experience meets the IE guidelines. With the exception of student initiated IEs, courses/experiences to be taken for IE credit must be approved by the Curriculum Committee prior to the pre-registration period for the semester in which the course is to be offered or the project/experience is to be undertaken. An IE course cannot be taken with a Pass/Fail grading type to satisfy the IE graduation requirement. A list of currently approved Integrative Experience courses and guidelines for creating individual Integrative Experiences is maintained by the Office of the Dean of Faculty.

INTEGRATIVE EXPERIENCE (IE) COURSES

81. HUMAN PHYSIOLOGY AND DISEASE (3)

Abn. This course will provide an overview of the organ systems in the human body and their corresponding diseases. Lectures will provide the general background in human anatomy and physiology, while student-driven presentations will examine diseases and disease-related issues that impact our society. Prerequisites: Biology 52 or approval from instructor. (Fall)

142. SEMINAR IN MATHEMATICS AND SCIENCE EDUCATION (3)

Yong, Dodds. Students will learn about and contribute to mathematics and science education in our community. Over the course of the semester, students observe mathematics and science classrooms and reach out to integrate with our readings and discussions, which will be centered around questions such as What is effective mathematics and science teaching?, What is effective mathematics and science education?, and How does mathematics and science education impact our society?

144. MATHEMATICS, MUSIC, ART: COSMIC HARMONY (3)

Alves, Orrison. A seminar exploring some of the many intersections between mathematics and music within our own and non-Western cultures, including proportion in art, tuning systems, algorithmic composition, artificial intelligence and creativity, and music synthesis. The class will also examine the ethical, aesthetic, and cultural ramifications of compression technology, sampling, downloading, and the effects of technology on music and vice-versa.

150. PUBLIC SPEAKING FOR SCIENCE AND CITIZENSHIP (3)

Steinberg. This course builds student speaking skills in three areas: communicating advanced topics in science and technology to non-specialists; speaking out on questions of politics and values; and engaging the intersection of the two through presentations on technically intensive social controversies. 3 credit hours.

162. BEYOND CALCULATION (3)

Erlinger. Students will review the history of computing, the current state of computing, and various predictions of the future of computing through lecture, literature research, presentations and short papers. The reviews will encompass social and economic aspects of computing along with the technical aspects. Using the above three views of computing and their breadth in science and the humanities, students will produce their own prediction of everyday computing in ten or fifteen years. These predictions will be done by means of a research paper and class presentation. Student predictions will include all aspects of the computing equation: scientific, economic and social.

171. BUILDING LOS ANGELES (3)

Groves and Petersen. This course explores the complex network of urban communities in which we live in order that we might think more deeply about the relationship of the built to the natural environment. To complicate our conceptions of Los Angeles, we will consider the city's history and the massive infrastructure that allows it to function. We will focus for a substantial part of the course on architecture, which can be a profound expression of the relationship between the built and the natural. And we will explore contemporary developments, including adaptive re-use, the new urbanism, and green design. (Offered alternate years in Fall semester)

187. HIV/AIDS: SCIENCE, SOCIETY AND SERVICE (3)

Haushalter. Molecular biology of HIV infection. Biochemical basis for antiretroviral therapy and HIV prevention strategies. The causes and impact of the global HIV/AIDS pandemic, including the interrelationships among HIV/AIDS, prejudice, race and stigma. Students will complete a community service project in partnership with a local AIDS organization. Prerequisites: Biology 113, Biology 182/Chemistry 182 or permission of the instructor. (Fall; offered in 2010)

198. SOCIAL CHOICE AND DECISION MAKING (3) (Also listed as Mathematics 188)

Su. Basic concepts of game theory and social choice theory, representations of games, Nash equilibria, utility theory, non-cooperative games, cooperative games, voting games, paradoxes, Arrow's impossibility theorem, Shapley value, power indices, "fair division" problems and applications. Prerequisite: Mathematics 63 and (recommended) Mathematics 55 or permission of instructor. (Offered alternate years in Spring)

Other courses can be designated as IE courses depending on the instructor and teaching methods of the course for the semester. Such courses have included the following:

ANTH110. LIFE: KNOWLEDGE AND PRACTICES

ANTH111. INTRODUCTION TO THE ANTHROPOLOGY OF SCIENCE AND TECHNOLOGY

BIOL082. CURRENT ISSUES IN BIOLOGY

ECON150. POLITICAL ECONOMY OF HIGHER EDUCATION

ENGR138. INTRODUCTION TO ENVIRONMENTAL ENGINEERING

ENGR174. PRACTICES IN CIVIL ENGINEERING

ENGR201. ECONOMICS OF TECHNICAL ENTERPRISE

HIST184. SCIENCE AND RELIGION

MATH188. SOCIAL CHOICE AND DECISION MAKING

PHIL125. ETHICAL ISSUES IN SCIENCE AND ENGINEERING

PHYS080. ENERGY AND THE ENVIRONMENT

RLST184. SCIENCE AND RELIGION

SOSCI180. TROPICAL FORESTS: POLICY AND PRACTICE

STS 001. INTRODUCTION TO SCIENCE, TECHNOLOGY AND SOCIETY

STS 114. SOCIAL AND POLITICAL ISSUES IN CLINIC

STS 124. U.S. SCIENCE AND TECHNOLOGY POLICY

STS 185. SCIENCE AND ENGINEERING FROM AN "OTHER" PERSPECTIVE

STS 187. HIV/AIDS: SCIENCE, SOCIETY AND SERVICE

See the corresponding departmental course listing for a description of these courses.

PHYSICAL EDUCATION

The physical education requirement helps students develop skills for lifelong physical fitness. Students must register for a physical fitness course in their first year, and the typical student must complete three courses of physical education. For further details, and for information about the relationship of intercollegiate and approved club sports to the physical education requirement, see Physical Education in the Departmental Programs section, page 90.

MAJORS (IN GENERAL)

A student must complete the requirements for one of the departmental majors, one of the interdisciplinary majors, an approved individual program of studies (IPS), or an off-campus major (OCM) and technical minor with approval from the Associate Dean for Academic Affairs. The departmental majors are: biology, chemistry, computer science, engineering, mathematics and physics. There are currently three interdisciplinary majors: chemistry and biology, computer science and mathematics, and mathematical biology. Requirements for each major are listed in that major's section of this catalogue.

Every student should seek early guidance from faculty advisors in order to clarify the preparation required for specific majors. Typically, students either select a major or file a tentative IPS plan by the end of the fourth semester.

In the junior and senior years, students take two or three courses each semester in their major and related fields. Some of these are requirements while others are electives. All majors culminate in original research and design opportunities.

STUDY ABROAD AND DOMESTIC EXCHANGES

Harvey Mudd College students may spend a semester or a year studying at a university abroad, or they may choose to participate in the domestic exchange program with Swarthmore College or Rensselaer Polytechnic Institute in Troy, N.Y. This is most commonly done in the junior year.

Study Abroad

The Harvey Mudd College Study abroad program provides students the opportunity to develop an international perspective and broaden their education in ways not possible in Claremont. For this reason, it is recommended that students select courses unique to their site.

Students normally take a course load equivalent five HMC semester courses (15–16 credit hours), whether or not they need the credits to graduate. Except under extraordinary circumstances, overloads will not be approved. Students should discuss course selection with both of their faculty advisors.

Departmental approval is required for all courses to be counted toward their major or humanities/social sciences requirements, and is also a requirement to go abroad. It is highly advised that you retain all syllabi, reading lists, copies of submitted work, including all papers and exams as a record of your academic performance abroad.

Because the College wants all students' study abroad decisions to be driven by academic, rather than financial factors, students pay a comprehensive fee to HMC that covers the costs of the academic program, reasonable room and board in the host country, and an allowance for round-trip transportation to the program site.

Because students remain enrolled at HMC, those on financial aid normally receive their regular assistance while on a semester or year abroad. Students interested in taking a Leave of Absence (LOA) to study abroad for a semester should note that their courses will not transfer back as HMC credit.

Acceptance to most programs is a two-step process requiring both HMC and the program sponsor or host institution approval. Students should be able to follow university lectures in the language in which they are given, participate in seminar discussions, take notes and understand written material in their field. Generally, four or five semesters of a foreign language at the university level is required.

Students must participate fully in all orientation and evaluation processes offered by HMC and the host institution as well as observe HMC and host institution deadlines for the submission of all required materials.

Credit toward graduation from HMC is granted only to participants in programs of study officially approved by the HMC Study Abroad Committee.

All courses taken while studying abroad are to be taken for a grade unless the course is only offered on a Pass/Fail credit basis. Transfer credit will be awarded only on grades of C or better and some departments require grades of B or better for courses to fulfill major requirements. It is advised that students verify the departmental minimum grade requirements. All grades received will appear on the HMC transcript, but the grades will not be computed into the HMC cumulative GPA.

Grades for the semester prior to departure will be reviewed before final approval is granted for participation in study abroad. Should grades fall below qualifying standards, approval for participation will be withdrawn.

It is the student's responsibility to consult with her/his academic advisors to affirm the applicability of her/his proposed coursework. Any changes from this plan should be communicated, in writing, to the advisor and the Study Abroad Office. HMC's acceptance of coursework taken abroad is contingent upon approval by the student's major department, the Humanities, Social Sciences, and the Arts Department and the Registrar. For further information see the Study Abroad site, www.hmc.edu/academicsclinicresearch/internationalopportunities/studyabroadprogram.html.

All students participating in study abroad are required to carry comprehensive health insurance. In addition, an International Student Identity Card (ISIC) is required as a supplement to their original insurance policy.

All students accepted for studying abroad affirm their understanding that they must conform to rules and regulations not only of HMC, but also of the program and the country in which they study. Failure to do so may result in the student being immediately discharged from the program and returned home, at their expense, without a refund of program fees.

Students accepted for studying abroad affirm the additional academic and personal risk involved and recognize as well the limited responsibility of the College for such programming. Before final approval for participation is given, each applicant must complete the Waiver, Release and Indemnification Agreement that outlines the limits of the College's liability.

A list of students approved by the HMC Study Abroad Committee will be forwarded to the HMC Dean of Students, the HMC Registrar, and to Monsour Counseling and Psychological Services of The Claremont Colleges.

Domestic Exchange Program

Students may participate in the Domestic Exchange Program during their sophomore or junior year. The application is processed through HMC and students may choose to attend Swarthmore College or Rensselaer Polytechnic Institute for a semester. Cost for the program is the same as if the student were on-site at HMC; payment is made to HMC and payment plans may continue to be implemented.

Students are able to enroll in the same manner as students at the host college, and transfer credit is awarded on grades of C or better. Some departments require grades of B or better for courses to fulfill major requirements. Information on these programs is available in the Office of Academic Affairs, Joseph B. Platt Campus Center.

DEPARTMENTS AND PROGRAMS

BIOLOGY

(See also **Mathematical Biology and Joint Major in Chemistry and Biology**)

Professors Adolph (Chair), Ahn, Asai (on leave 2010-11), Bush, Drewell, Haushalter, McFadden and Stoebel; *Visiting Professor* Hamlett; *Teaching Postdoctoral Fellow* Poon

The biology program prepares graduates for further study and employment in biology and related fields. Biology graduates work in biotechnology, mathematical ecology, medicine, vaccine research, molecular genetics, dentistry, bioinformatics, pharmacology, neurobiology, veterinary medicine, forensic science, conservation biology, science teaching, environmental activism, and other areas.

The HMC biology major, in conjunction with the common technical Core, provides the topical breadth that is the foundation of modern biology, and the intellectual depth that enables students to understand how discoveries in the life sciences are made and communicated. A set of required Biology Core courses provides a broad foundation in biology. Building on this foundation, each student, in consultation with a biology faculty advisor, selects a group of advanced biology and related technical courses that introduce a life sciences subdiscipline in depth. In addition to Harvey Mudd courses, students may draw upon the extensive course offerings at Pomona College, the Joint Science Department of Claremont McKenna, Pitzer, and Scripps Colleges, the Keck Graduate Institute of Applied Life Sciences, and the Rancho Santa Ana Botanic Garden.

BIOLOGY MAJOR REQUIREMENTS. A biology major must successfully complete the following courses:

BIOLOGY CORE

Biology 54. **BIOLOGY LABORATORY**

Biology 101. **COMPARATIVE PHYSIOLOGY**

Biology 108. **ECOLOGY & ENVIRONMENTAL BIOLOGY**

Biology 109. **EVOLUTIONARY BIOLOGY**

Biology 113. **MOLECULAR BIOLOGY**

Chemistry 56. **CARBON COMPOUNDS**

Chemistry 58. **CARBON COMPOUNDS LABORATORY**

Chemistry 105. **ORGANIC CHEMISTRY**

Biology Electives

Thirteen units of advanced biology, selected by the student and advisor, to include at least two HMC laboratory courses (selected from Biology 103, 110, 111, 184) and one HMC seminar-style course (requiring student presentations and reading from the primary literature, selected from Biology 121, 122, 164, 183, 189). Related non-biology technical courses may be substituted for advanced biology courses with permission of the department. With prior departmental permission, up to two credits of Biology 197/198 (Directed Reading) may count as Biology Electives.

Colloquium

Four semesters of Biology 191–192: Biology Colloquium.

The Biology 191–192 Biology Colloquium requirement is waived for any semester during which a student is away on a study abroad program.

Capstone Project

Two semesters (at least 6 credits total) of Senior Thesis Research (Biology 193–194, or Biology 195–196) or an approved biology-related Clinic (Computer Science 183–184, Engineering 111–114, Environmental Studies 190, Mathematics 193 or Physics 193–194).

MOLECULAR BIOLOGY OPTION

Students may also select the molecular biology option within the biology major. A student seeking to complete the molecular biology option must satisfactorily complete the following courses:

MOLECULAR BIOLOGY CORE

Biology Core from above, plus the following additional courses and modified requirements:

Biology 111. **MOLECULAR BIOLOGY LABORATORY**

Biology 182. **CHEMISTRY IN LIVING SYSTEMS**

Chemistry 51. **PHYSICAL CHEMISTRY**

Chemistry 111. **ORGANIC CHEMISTRY LABORATORY**

Electives

Eight units of approved biology electives, selected by the student and advisor, to include at least one HMC laboratory course (Biology 103, 110, 184) and one HMC seminar-style course (requiring student presentations and reading from the primary literature, selected from Biology 121, 122, 164, 183, 189). One chemistry course may be substituted for an advanced biology course with the prior approval of the department.

Colloquium

Four semesters of Biology 191–192: Biology Colloquium, or Chemistry 199: Chemistry Seminar. The colloquium requirement is waived for any semester during which a student is away on a study abroad program.

Capstone Project

Two semesters (at least 6 credits total) of Senior Thesis Research (Biology 193–194 or Biology 195–196 or Chemistry 151–152).

JOINT MAJOR IN CHEMISTRY AND BIOLOGY

Important opportunities are emerging at the interface of chemistry and biology. The Joint Major in Chemistry and Biology provides an organized framework in which students will be able to appreciate the biological context of their research questions and master the chemistry fundamentals that underlie the properties and reactions of biomolecules. Students interested in the Joint Major, which is administered by the Departments of Biology and Chemistry, should contact the Chairs of Biology and Chemistry.

ENVIRONMENTAL BIOLOGY

Harvey Mudd College is part of a consortium that enables HMC students to participate in the Semester in Environmental Science (SES) at the Ecosystems Center of the Marine Biological Laboratory, Woods Hole, Mass. This semester-long program emphasizes interdisciplinary, inquiry-based approaches to the in-depth study of both aquatic and terrestrial ecosystems. Biology 171 and 173 are only offered as part of this program. Students interested in this program should contact Professor Catherine McFadden for information and applications. The Department of Biology also participates in the HMC Center for Environmental Studies, which coordinates multi-disciplinary programs in environmental studies. For more information or to design an environmental studies concentration, contact Professor Stephen Adolph, the Environmental Studies advisor for the Department of Biology.

MATHEMATICAL BIOLOGY

Applications of mathematics and computer science are vital to many areas of contemporary biological and medical research, such as genomics, molecular modeling, structural biology, ecology, evolutionary biology, neurobiology and cancer treatment. Students interested in the connections between biology, computer science and mathematics may pursue the Mathematical Biology Major, which is jointly administered by the Departments of Biology and Mathematics. For more information contact Professors Stephen Adolph (Biology), Eliot Bush (Biology), Lisette de Pillis (Mathematics), Jon Jacobsen (Mathematics), and/or Ran Libeskind-Hadas (Computer Science).

HEALTH PROFESSIONS

An excellent premedical preparation can be obtained at HMC. In fact, the College's emphasis on the humanities and the social sciences is a valuable asset for pre-medical studies. While there is no specific premedical curriculum, a premedical program can be arranged through any of the majors, if supplemented by appropriate biology and chemistry course work. Most medical schools require, as a minimum, one year of physics and biology and four semesters of chemistry, including organic chemistry. Students interested in medicine or related fields, such as dentistry or veterinary medicine, should contact the pre-professional coordinators, Professors Karl Haushalter and Robert Drewell, for advice.

FACILITIES

The biology department is housed in the F.W. Olin Science Center, which provides exceptionally well-equipped teaching and research laboratories to support our laboratory-centered curriculum. The Robert J. Bernard Biological Field Station, located directly across the street from Harvey Mudd College, is the natural laboratory for field biology courses and student-faculty research. Automated DNA sequencing is carried out at the adjacent Rancho Santa Ana Botanic Garden.

RESEARCH

Areas available for student-faculty research within the department include biochemistry, cellular and developmental biology, molecular genetics, population biology, physiological ecology, biomechanics, animal locomotion, tissue engineering, animal behavior, bioinformatics, mathematical ecology, computational genetics, and molecular evolution. Students wishing to pursue research prior to their senior year may enroll in Biology 161-162, Research Problems, or Biology 197-198, Directed Reading. Summer research positions are also available. Contact the Department of Biology Research Coordinator, Professor Catherine McFadden, for details and applications.

BIOLOGY COURSES**52. INTRODUCTION TO BIOLOGY (3)**

Adolph, Bush, Drewell, Stoebel. Topics in genetics, molecular biology and evolution. Prerequisites: one semester of general chemistry and one semester of calculus. (Fall and Spring)

54. BIOLOGY LABORATORY (1)

Ahn, Hamlett, McFadden. Investigations in physiology, biochemistry, ecology, molecular biology and other areas of experimental biology. Prerequisite: Biology 52 (may be taken concurrently). (Spring)

81, 82. CURRENT ISSUES IN BIOLOGY (3)

Staff. Study of a biological topic of current importance to society. Active participation and discussion are stressed. It is expected that this course will usually count for Integrative Experience credit. (May not be counted for credit toward the biology major.) Prerequisite: Depends upon topic. (Fall or Spring)

95. FOUNDATIONS OF NEUROSCIENCE (3)

Staff. Introduction to the biological bases of human and animal behavior. Analysis of modern neurobiological approaches within a framework established by philosophical and historical traditions in the neurosciences. This course is jointly taught by Claremont Colleges Neuroscience faculty. (May not be counted for credit toward the biology major.) (Fall)

101. COMPARATIVE PHYSIOLOGY (3)

Ahn. Topics in the structural basis underlying general physiological mechanisms of plants and animals. Prerequisite: Biology 52. (Spring)

103. COMPARATIVE PHYSIOLOGY LABORATORY (2)

Ahn. Experimental techniques and concepts in plant and animal physiology, including the general areas of cellular biology, energetics, ionic regulation and signaling. The final third of the course will involve independent student research projects culminating with oral and written presentations of experimental investigations. Prerequisites: Biology 52, Biology 54, Biology 101. (Fall)

108. ECOLOGY AND ENVIRONMENTAL BIOLOGY (3)

Adolph, McFadden. Principles of organization of natural communities and ecosystems, including population dynamics, species interactions and island biogeography. Modern experimental and mathematical approaches to ecological problems. Application of ecological principles to conservation biology, human demography and harvesting of natural resources. Prerequisites: Biology 52 and Mathematics 11 or 25. (Spring)

109. EVOLUTIONARY BIOLOGY (3)

McFadden. Evolutionary mechanisms, including natural selection, population genetics, speciation and macroevolutionary processes. Modern methods of phylogenetic reconstruction. History of biological diversity and the fossil record. Prerequisite: Biology 52. (Fall)

110. EXPERIMENTAL ECOLOGY LABORATORY (3)

McFadden. Design and analysis of ecological experiments with an emphasis on hypothesis testing, sampling techniques and computer-based statistical analysis of data. Most projects are field-based, designed to address aspects of population, community, physiological and behavioral ecology in animals and plants; work in both terrestrial and aquatic habitats. Includes several all-day field trips to local coastal, desert and mountain sites. Prerequisites: Biology 54 and 108 (may be taken concurrently) or permission of instructor. (Spring)

111. MOLECULAR AND CELLULAR BIOLOGY LABORATORY (2)

Bush, Hamlett, Poon. Basic techniques of molecular biology, including restriction mapping, DNA cloning, protein expression, and fluorescence microscopy. Prerequisites: Biology 54 and 113 (may be taken concurrently) or permission of instructor. (Fall)

113. MOLECULAR BIOLOGY (3)

Drewell, Stoebel. Molecular description of gene function in both prokaryotic and eukaryotic cells, including DNA, RNA and protein structure; DNA replication; transcription and translation; and gene regulation. Prerequisites: Biology 52 and Chemistry 56 or permission of instructor. (Fall)

118. MATHEMATICAL BIOLOGY I (2) (Also listed as Mathematics 118)

Adolph, de Pillis (Mathematics), Jacobsen (Mathematics). Mathematical models of biological processes emphasizing continuous models. May include models in epidemiology, population dynamics, cancer modeling and disease treatment modeling. Prerequisites: Mathematics 64 or 65, Biology 52, or permission of instructor. (First half of Spring)

119. MATHEMATICAL BIOLOGY II (2) (Also listed as Mathematics 119)

Adolph, de Pillis (Mathematics), Jacobsen (Mathematics). Mathematical models of biological processes emphasizing discrete and continuous models. May include one- and two-locus population genetics, metapopulations and matrix population models as well as models in physiology and neurobiology. Prerequisites: Mathematics 64 or 65, Biology 52, or permission of instructor. (Second half of Spring)

121. MARINE ECOLOGY (3)

McFadden. Advanced ecology focusing on marine communities. Dispersal, recruitment, competition, disturbance, plant/animal interactions and other topics. Readings in the primary literature. Counts as a seminar course for Biology majors. Prerequisite: Biology 108 or permission of instructor. (Fall, alternate years—offered in Fall 2010)

122. CELL AND DEVELOPMENTAL BIOLOGY (3)

Drewell. Cellular and molecular mechanisms of animal development, including cell fate determination, morphogenesis and pattern formation. Emphasis on modern experimental organisms and approaches. Readings in the primary literature. Counts as a seminar course for Biology majors. Prerequisite: Biology 113 or equivalent or permission of instructor. (Spring, alternate years—offered in Spring 2012.)

126. BIOLOGY OF PROKARYOTES (3)

Staff. Current topics in prokaryotic biology jointly selected by students and instructor. Emphasis on molecular mechanisms of adaptation to diverse environments. Primarily seminar format with readings from the primary literature. Prerequisite: Biology 113 or permission of instructor.

128. PROKARYOTES LABORATORY (2)

Staff. Techniques for isolating, identifying and characterizing bacteria from diverse environments. Prerequisites: Biology 54 and 126 (may be taken concurrently).

153. BIostatistics (3)

Adolph. Statistical techniques for analyzing biological data, including both parametric and non-parametric methods. Statistical aspects of experimental design. Additional topics may include spatial statistics, circular statistics, multivariate methods, randomization tests and bootstrapping. Prerequisites: Biology 52 and Mathematics 35 or 62 or permission of the instructor. (Fall)

161, 162. RESEARCH PROBLEMS (1-3)

Staff. Original experimental investigations in biology undertaken in consultation with a faculty member. (May not be counted for credit toward the biology major.) Prerequisite: permission of instructor. 1 credit hour for each 3 hours of laboratory per week. (Fall and Spring)

164. GENETICS (3)

Drewell, Stobel. Current topics in genetics and developmental genetics. Emphasis on experimental techniques and design with model experimental organisms. Readings from the primary literature. Counts as a seminar course for biology majors. Prerequisites: Biology 54 and Biology 113. (Spring, alternate years—offered in Spring 2011)

166. CELL BIOLOGY AND GENETICS LABORATORY (2)

Staff. Techniques for investigations of protein localization, organelle isolation, genetic mapping, and fluorescence microscopy. Laboratories consist of student projects. Prerequisites: Biology 54 and Biology 113; corequisite: Biology 164 or permission of instructor.

171. ANALYSIS OF AQUATIC ECOSYSTEMS. MARINE BIOLOGICAL LABORATORY (MBL) (4)

MBL Staff. The nature and controls of ecosystem processes (production, decomposition, element cycling and biogeochemistry) in freshwater, estuarine and marine ecosystems. Application of basic principles of ecosystems ecology to contemporary environmental problems such as coastal eutrophication, fisheries exploitation, effects of introduced species, acid deposition and global change. Includes lecture, discussion, laboratory and field work. Prerequisites: Biology 52, 54, Chemistry 23, 24 and Mathematics 11 or 25. (Fall) Offered only through the Semester in Environmental Science Program at the MBL Ecosystems Center, Woods Hole, Mass.

173. ANALYSIS OF TERRESTRIAL ECOSYSTEMS (4)

MBL Staff. Fundamental biogeochemical processes in fields, pastures, tundra and forested ecosystems. Physiological ecology of land- plants and soil organisms in an ecosystems context. Impacts of environmental change on the landscape at local, regional and global scales. Includes lecture, discussion, laboratory and field work. Prerequisites: Biology 52, 54, Chemistry 23, 24 and Mathematics 11 or 25. (Fall) Offered only through the Semester in Environmental Science Program at the MBL Ecosystems Center, Woods Hole, Mass.

174. BIOPHYSICS (2) (Also cross-listed as Physics 174)

Haskell (Physics). Selected topics in biophysics reflecting areas of active research in the field. Possible topics: imaging techniques, membrane biophysics, sensory transduction, motility. Seminar format. Prerequisites: Biology 52 and Physics 51. (Second half of Spring)

178, 179. BIOLOGY CLINIC (3)

Contact Chair of Biology. Team projects in biology, with corporate affiliation. Prerequisite: Upper-division standing. (Fall and Spring)

182. CHEMISTRY OF LIVING SYSTEMS (3)

Haushalter, Vosburg (Chemistry). Relation of molecular structure and energy flow to reactions in living systems. Prerequisite: Chemistry 105. (Spring)

183. TOPICS IN PHYSIOLOGY (3)

Abn. Readings from the primary literature in animal physiology. Specific topics may vary. Counts as a seminar course for Biology majors. Prerequisites: Biology 52, Biology 101 or consent of instructor. (Fall, alternate years—offered in Fall 2011)

184. METHODS IN BIOCHEMISTRY (1)

Haushalter, Vosburg (Chemistry). Experiments in biochemistry. Prerequisite: Biology/Chemistry 182 (may be taken concurrently). (Spring)

185, 186. SPECIAL TOPICS IN BIOLOGY (3)

Staff. Topics in a particular area of biology, depending on the instructor. Prerequisites: Biology 52, and possibly other courses. (Fall and Spring)

187. HIV-AIDS: SCIENCE, SOCIETY AND SERVICE (3)

Haushalter. Molecular biology of HIV infection. Biochemical basis for antiretroviral therapy and HIV prevention strategies. The causes and impact of the global HIV-AIDS pandemic, including the interrelationships among HIV-AIDS, prejudice, race and stigma. Students will complete a community service project in partnership with a local AIDS organization. Prerequisites: Biology 113, Biology 182/Chemistry 182 or permission of the instructor. (Fall; offered in 2010)

188. COMPUTATIONAL BIOLOGY (3)

Bush. Computational algorithms and methods used in the study of genomes. Lectures, discussions and computer laboratory exercises. Prerequisites: Biology 52 and Computer Science 5 or permission of instructor. (Spring)

189. TOPICS IN BIOCHEMISTRY AND MOLECULAR BIOLOGY (3)

Haushalter, staff. Advanced topics at the interface between chemistry and biology. Counts as a seminar course for Biology majors. Prerequisites: Biology 113 or permission of the instructor. (Fall)

190B. BIOMECHANICS (3) (Also cross-listed as Engineering 190B)

Ahn, Orwin (Engineering). Mechanical properties of biological tissues, including bone, connective tissue and muscles. Static analysis of joints. Analysis of how muscle generates motion, leading to dynamics, including kinematics, kinetics and locomotion, and how these principles scale for different sized animals. Focus on applications and primary literature. Prerequisites: Biology 52 and Engineering 83 or permission of instructor. (Fall, alternate years)

191, 192. BIOLOGY COLLOQUIUM (0.5)

Staff. Oral presentations and discussions of selected topics including recent developments. Participants include biology majors, faculty members and visiting speakers. Required for junior and senior biology majors. No more than 2.0 units of credit can be earned for colloquium. Pass/No Credit grading. (Fall and Spring)

193, 194. SENIOR THESIS RESEARCH (3)

Staff. A year-long experimental investigation in biology under the direction of a faculty advisor. Two oral presentations, a written proposal and a thesis are required. Required of all senior biology majors. Prerequisite: permission of instructor. (Fall and Spring)

195, 196. INTENSIVE RESEARCH (6)

Staff. Intensive experimental research in biology undertaken in consultation with a faculty member. Prerequisite: Biology 161, 162 or 193 and departmental approval of formal application. Replaces 3 units of 193-194 and 3 units of advanced biology courses for credit toward biology major. (Fall and Spring)

197, 198. DIRECTED READING (1-3)

Staff. Directed readings or independent laboratory research in selected topics in biology. With prior permission, up to 2 credits may count toward biology major. Prerequisite: permission of instructor. (Fall and Spring)

CHEMISTRY**(See also Joint Major in Chemistry and Biology)**

Professors Van Ryswyk (Chair), Baker, Cave, Clements (2010-11), Daub, Haushalter, Johnson, Karukstis, Kubota (emeritus), Maloney, Myhre (emeritus), Van Hecke and Vosburg.

The central program in chemistry provides instruction that prepares graduates for careers and advanced study in chemistry and related fields. Following the core courses in chemistry, the chemistry program consists of a set of intermediate lecture and laboratory courses that provide necessary breadth. The advanced courses and experimental research or project work in the senior year provide opportunities for in-depth study of selected areas.

A second program, administrated jointly by the departments of chemistry and biology, is the Joint Major in Chemistry and Biology. This joint major provides an opportunity for students interested in study at the interface between chemistry and biology. Students wishing to study such interdisciplinary areas as biochemistry, molecular biology, biological chemistry and chemical biology will find this program well tailored to their postgraduate plans. Details on this program are listed in the "Interdisciplinary Programs" section of the catalogue.

The chemistry faculty believe that research or project work on a significant chemical problem is an exceptionally valuable educational experience; all majors must participate in such a project. The department is exceptionally well equipped with the instrumentation necessary for this research work and has a strong record of research productivity.

Students completing the chemistry major have an exceptionally strong and broad background for immediate employment, professional school (business, law or medicine), or graduate work in chemistry or a wide range of allied fields. Our alumni work not only in chemistry, but in materials science, chemical engineering, biochemistry, pharmacology, molecular biology, genetics, oceanography, teaching, publishing and viticulture. All chemistry graduates are certified by the American Chemical Society (ACS).

Students completing the Joint Major in Chemistry and Biology graduate with a clear view of the science in both disciplines. Such a degree will prepare the graduate for advanced study in molecular biology, biological chemistry, biochemistry or chemical biology. This degree is not an ACS certified chemistry major; students wishing to obtain ACS certification can do so by taking Chem 104.

CHEMISTRY MAJOR REQUIREMENTS. A chemistry major must satisfactorily complete the following courses: Chemistry 51, 52, 53, 56, 58, 103, 104, 105, 109, 110, 111, 112, 114, four to six hours of Chemistry 151–152, Chemistry 182 and four semesters of Chemistry 199.

The requirement for one semester of Chemistry 199 can be waived for students studying abroad in their junior or senior years.

Students can, in consultation with their advisor, build upon the chemistry degree by taking additional courses tailored to their interests. Sample programs supporting a broad array of career paths are listed:

Applied Chemistry or Graduate Study in Chemical Engineering: Chemistry 166, Engineering 82 (Chemical and Thermal Processes), Engineering 131 (Fluid Mechanics) or 132 (Heat Transfer), Engineering 136 (Mass Transfer and Separation Processes) and Engineering 133 (Chemical Reaction Engineering). Engineering 112–113 (Clinic) may be substituted for Chemistry 151–152.

Biological Chemistry: Chemistry 184, Biology 54 (Biology Laboratory), Biology 111 (Molecular and Cellular Biology Laboratory), Biology 113 (Molecular Biology), one biology elective or two courses selected from Chemistry 168B, Chemistry 189, JS Chemistry 172 (NMR Spectroscopy), JS Chemistry 118 (Bioinorganic Chemistry), JS Chemistry 119 (Natural Products Chemistry), JS Chemistry 134 (Introduction to Molecular Modeling), PO Chemistry 174 (Bio-Organic), PO Chemistry 175 (Introduction to Medicinal Chemistry with Computational Lab), or PO Chemistry 180 (Advanced Biochemistry).

Chemical Education: CGU Education 170G (Introduction to Public School Teaching) and Chemistry 197–198 as a 3-unit teaching internship under the supervision of a local K–12 teacher involving a minimum of 3 hours per week of classroom contact.

Chemical Physics: One additional physics course beyond the Core, plus 6 credit hours of study selected from Chemistry 161 or Physics 117 (Statistical Mechanics and Thermodynamics), Chemistry 168, Physics 111 (Theoretical Mechanics), Physics 116 (Quantum Mechanics), Physics 151 (Electromagnetic Fields), Mathematics 115 (Fourier Series and Boundary Value Problems), Mathematics 136 (Complex Variables and Integral Transforms), or other advanced courses in chemistry, physical chemistry or mathematics.

Computational Chemistry: Three courses selected from Chemistry 161 or Physics 117 (Statistical Mechanics and Thermodynamics), JS Chemistry 134 (Introduction to Molecular Modeling), Computer Science 60 (Principles of Computer Science), Mathematics 164 (Scientific Computing), Mathematics 167 (Complexity Theory), Physics 111 (Theoretical Mechanics), Physics 116 (Quantum Mechanics), or another advanced course in computer science, physics or chemistry.

Environmental Chemistry: JS Chemistry 139 (Environmental Chemistry), Engineering 138 (Introduction to Environmental Engineering), and two courses in environmental policy.

Graduate Study in Chemistry: Chemistry 161, a half-course emphasizing synthetic chemistry (Chemistry 165, 171, or 173), and a technical elective.

Geochemistry: PO Geology 20 (Introduction to Geology), PO Geology 120 (Introduction to Geochemistry), and PO Geo 127 (Mineralogy with Laboratory).

Materials Chemistry: Engineering 106 (Materials Engineering), Chemistry 193A, and Physics 162 (Solid State Physics).

Medical School: There is no specific premedical track at HMC. However, an excellent premedical preparation can be obtained at HMC. In fact, the College's emphasis on the humanities and the social sciences is an asset for premedical studies. A premedical program can be arranged through any of the majors, if supplemented by appropriate biology and chemistry course work. Students should consult with the premedical advisor, Professor Karl Haushalter, for more information.

Students are encouraged to discuss professional options and opportunities with members of the chemistry department.

CHEMISTRY COURSES**19. GENERAL CHEMISTRY INTENSIVE (0.5)**

Johnson. Companion course to Chemistry 23 emphasizing chemistry fundamentals and problem-solving in a group setting. (Fall, first and second half semester)

23D. DYNAMICS (1.5)

Karukstis. Kinetics, equilibria, acid/base chemistry and electrochemistry. (Spring)

23E. ENERGETICS (1.5)

Clements, Van Hecke. Phase behavior, equations of state, intermolecular forces, thermodynamics and electrochemistry. (Fall)

23S. STRUCTURE (1.5)

Maloney. Molecular and electronic structure, intermolecular forces, condensed phases, organic structure and properties and biopolymers. (Fall)

24. CHEMISTRY LABORATORY (1)

Staff. Applications of thermodynamics, equilibria, electrochemistry, structure/property relationships, synthesis, spectroscopy and chemistry in the service of society. (Fall and Spring)

51. PHYSICAL CHEMISTRY: THERMODYNAMICS AND KINETICS (3)

Karukstis. Phase equilibria, thermodynamics and chemical kinetics. Prerequisites: Chemistry 21–22 and 25–26. (Fall)

52. PHYSICAL CHEMISTRY: GROUP THEORY, QUANTUM CHEMISTRY AND SPECTROSCOPY (3)

Van Hecke. Introduction to quantum mechanics with application to atoms and molecules. Group theory. Survey of spectroscopic techniques. Prerequisites: Chemistry 21–22 and 25–26. (Spring)

53. PHYSICAL CHEMISTRY LABORATORY (2)

Karukstis, Van Hecke. Physical chemical measurements of molecular properties. Prerequisite: Chemistry 51 or taken concurrently. (Fall)

56. CARBON COMPOUNDS (3)

Maloney. A systematic study of the chemistry of carbon-containing compounds, emphasizing synthesis, reaction mechanisms, and the relation of structure to observable physical and chemical properties. Prerequisites: Chemistry 21–22 and 25–26. (Spring)

58. CARBON COMPOUNDS LABORATORY (1)

Daub, Johnson, Maloney, Vosburg. Laboratory taken concurrently with Chemistry 56. Prerequisite: one year of college chemistry. (Spring)

103. CHEMICAL ANALYSIS (3)

Van Ryswyk. Applications of chemical equilibria in qualitative and quantitative analysis with emphasis on inorganic systems. Introduction to electrochemistry. Prerequisites: Chemistry 21–22 and 25–26. Chemistry 109 should be taken concurrently. (Fall)

104. INORGANIC CHEMISTRY (3)

Johnson. Systematic study of the preparation, properties, structures, analysis and reactions of inorganic compounds. Prerequisites: Chemistry 51, 52, 56 and 105, or equivalents or instructor approval. (Spring)

105. ORGANIC CHEMISTRY (3)

Vosburg. A continuation of the chemistry of carbon compounds. Prerequisite: Chemistry 56. Chemistry 111 should be taken concurrently. (Fall)

109. CHEMICAL ANALYSIS LABORATORY (1)

Van Ryswyk. Chemical analysis. Prerequisites: Chemistry 103 or taken concurrently. (Fall)

110. INORGANIC CHEMISTRY LABORATORY (1)

Johnson. Synthesis and characterization of inorganic compounds. Prerequisites: Chemistry 104 or taken concurrently. (Spring)

111. ORGANIC CHEMISTRY LABORATORY (1)

Daub, Maloney, Vosburg. Synthesis, characterization and analysis of organic compounds. Prerequisites: Chemistry 58, Chemistry 105 or taken concurrently. (Fall)

112. INSTRUMENTAL ANALYSIS LABORATORY (1)

Van Ryswyk. Instrumental methods of analysis. Prerequisites: Chemistry 114, or taken concurrently. (Spring)

114. ADVANCED ANALYTICAL CHEMISTRY (3)

Van Ryswyk. Special topics in analytical chemistry including instrumental analysis, electrochemistry, and chemometrics. Prerequisites: Chemistry 51 and 103. (Spring)

151–152. RESEARCH PROBLEMS (2-3)

Staff. Two oral reports and a written thesis are required. 2 or 3 credit hours per semester. (2 credit hours equals a minimum of 6 hours of laboratory per week, 3 credit hours equals a minimum of 10 hours of laboratory per week; additional library time is required.) Topics in chemical literature will be covered in the first three weeks of the fall semester. (Fall and Spring)

161. ADVANCED PHYSICAL CHEMISTRY (2)

Staff. Classical and Statistical Thermodynamics. Equilibrium thermodynamics with applications to chemistry. Prerequisites: Chemistry 51 or equivalent. (Offered alternate years)

165. ORGANOMETALLIC CHEMISTRY (2)

Johnson. Study of the metal carbon bond: synthesis, structure, bonding, reactivity and catalysis. Prerequisite: Chemistry 105 or equivalent (may be taken concurrently). (Fall)

166. INDUSTRIAL CHEMISTRY (2)

Van Hecke. Elements of chemical engineering for chemists. Organization and goals of industrial research. Readings, case studies and seminar discussions. Prerequisite: junior or senior standing. (Offered alternate years)

168A. ADVANCED PHYSICAL CHEMISTRY (2)

Van Hecke. Lasers in chemistry. Introduction to the principles of the operation of lasers. Prerequisite: Chemistry 52 or equivalent. (Offered alternate years)

168B. ADVANCED PHYSICAL CHEMISTRY (2)

Karukstis. Biophysical chemistry. Physical chemistry applied to answer questions involving the conformation, shape, structure, dynamics and interactions of biological macromolecules and complexes. Prerequisite: Chemistry 51 or equivalent. (Offered alternate years)

168D. ADVANCED PHYSICAL CHEMISTRY (2)

Cave. Electronic structure theory. (Offered alternate years)

171. ADVANCED ORGANIC CHEMISTRY (2)

Vosburg. Organic synthesis. Prerequisite: one year of organic chemistry. (Offered alternate years)

173. ADVANCED ORGANIC CHEMISTRY (2)

Daub. Pericyclic reactions. Prerequisite: one year of organic chemistry. (Offered alternate years)

182. CHEMISTRY IN LIVING SYSTEMS (3)

Haushalter, Vosburg. Relation of molecular structure and energy flow to reactions in living systems. Prerequisite: Chemistry 105. (Spring)

184. METHODS IN BIOCHEMISTRY (1)

Haushalter, Vosburg. Experiments in biochemistry. Prerequisite: Chemistry 182 or concurrently. (Spring)

187. HIV-AIDS: SCIENCE, SOCIETY AND SERVICE (3)

Haushalter. Integrative experience course that studies the molecular biology of HIV infection, the biochemistry of antiviral interventions, and the causes and impact of the global HIV-AIDS pandemic, including the interrelationships among HIV-AIDS, prejudice, race, and stigma. Students will complete a community service project in partnership with a local AIDS organization. Prerequisite: Biology 52. (Offered alternate years)

189. TOPICS IN BIOCHEMISTRY AND MOLECULAR BIOLOGY (3)

Staff. Advanced topics at the interface between chemistry and biology. Prerequisite: Biology 113 or instructor approval. (Fall)

193A. SPECIAL TOPICS (2)

Van Ryswyk. Materials science of energy conversion and storage. Prerequisite: Chemistry 52 and 104, or equivalent. (Offered alternate years)

197, 198. CHEMISTRY (1-3)

Staff. Special readings in chemistry. Open to seniors only. 1–3 credit hours per semester. (Fall and Spring)

199. SEMINAR (0.5)

Staff. Discussions of contemporary research by students, faculty and visiting scientists. Attendance by majors is required. No more than 2.0 units of credit can be earned for departmental seminars/colloquia. Pass/No Credit grading. (Fall and Spring)

Available at the other Claremont Colleges:

JS 118. BIOINORGANIC CHEMISTRY

JS 119. NATURAL PRODUCTS CHEMISTRY

JS 124. BIOANALYTICAL CHEMISTRY

JS 134. INTRODUCTION TO MOLECULAR MODELING

JS 136. MODERN MOLECULAR PHOTOCHEMISTRY

JS 139. ENVIRONMENTAL CHEMISTRY

JS 172. NMR SPECTROSCOPY

PO 106. ENVIRONMENTAL CHEMISTRY

PO 172. NMR SPECTROSCOPY

PO 174. BIO-ORGANIC CHEMISTRY

PO 175. INTRODUCTION TO MEDICINAL CHEMISTRY WITH COMPUTATIONAL LABORATORY

PO 180. ADVANCED BIOCHEMISTRY

PO 185. SOFT NANOMATERIALS

PO 187. PROTEINS AND ENZYMES

COMPUTER SCIENCE

(See also Joint Major in Computer Science and Mathematics)

Professors Erlinger (Chair), Alvarado, Dodds, Keller, Kuenning, Libeskind-Hadas, O'Neill, Stone and Sweedyk.

Computer science is an exciting and rapidly-evolving discipline with components of design, logic, mathematics, engineering and philosophy. The role of computer science can be characterized as providing the logical infrastructure for the modern, information-based society.

The Harvey Mudd College Computer Science major, established in 1992, provides a strong foundation in the fundamental principles and concepts of computer science through a blend of experimentation, theory and design. Our students are well-prepared to make contributions to the field of computing, to science within a computational framework, and to society in general through the development of tools and technologies that can have a significant, positive, societal impact.

Each computer science major participates in a year-long Computer Science Clinic project, addressing real-world problems provided by sponsors from industry and research laboratories. A Clinic project typically comprises three to five students, supervised by a faculty member and a liaison from the sponsor, working on a project from “concept to product.”

Computer science students may also engage in research with our faculty during both the academic year and the summer. Examples of recent student involvement in research include the design, analysis, and simulation of next generation optical networks; the design of a system that recognizes and correctly interprets human sketches of digital logic circuits on tablet computers; the design and implementation of new programming languages; research into issues of applying and deploying network security; and the design of vision algorithms for autonomous robots.

Graduates of the Computer Science program have gone on to work for a diverse set of employers and, in some cases, have started their own companies. Some employers that have hired our graduates in recent years include Apple Computer, FICO, Google, Green Hills Software, Hewlett-Packard, IBM, Jet Propulsion Laboratory, Lawrence Livermore National Laboratory, Lockheed-Martin, Microsoft, QUALCOMM, Rockwell, Stanford Linear Accelerator, Sun Microsystems and The Aerospace Corporation.

A significant fraction of our majors have gone on to graduate study. Some of the graduate programs where our students have enrolled include Caltech, Carnegie Mellon University, Cornell, Georgia Institute of Technology, Stanford, UC Berkeley, UC Davis, UCLA, UC San Diego, University of North Carolina, University of Illinois at Urbana-Champaign, University of Texas, University of Washington and University of Wisconsin. Our graduates have done advanced study in areas such as algorithm design and analysis, logical foundations of computer science, software engineering, computer graphics, networking, distributed systems, mobile computing, performance analysis, programming languages, computer architecture, computer operating systems, parallel computing, artificial intelligence, computer vision, robotics, speech understanding, virtual reality, artificial life, neural networks, human-computer interfaces and telecommunications. Most of these areas are introduced in courses at HMC.

All students at Harvey Mudd College are required to fulfill Computer Science 5 (Introduction to Computer Science) or its equivalent which provides an exposure to some major concepts in the discipline including functional programming, object-oriented programming, digital logic and computer organization, computability theory and societal issues. The computer science major continues with the foundation courses, starting with Computer Science 60 (Principles of Computer Science) which provide a broad exposure to many areas of computer science and further develop fundamental competence in programming, logic, algorithm analysis and computer structure. Mathematics 55 is taken to develop skills in discrete mathematics that are needed for advanced computer science areas. Computer Science 70 (Data Structures

and Program Development) improves the students' depth of programming competence and diversifies the set of data structures and corresponding analysis techniques to which the computer science student is exposed. Computer Science 81 (Computability and Logic) introduces the mathematical foundations of computer science, particularly logic, automata and computability theory, and demonstrates applications of the aforementioned areas to problems of practical significance.

Building on the foundation courses are the kernel courses. Computer Science 105 (Computer Systems) develops a deep understanding of computer structure and its relationship to correct and efficient program implementation. Computer Science 121 (Software Development) focuses on requirements analysis and specification techniques for large software systems and the project management skills needed to develop such systems. Computer Science 131 (Programming Languages) investigates concepts underlying a wide variety of modern programming languages. Computer Science 140 (Algorithms) develops fundamental skills needed to perform comparative analysis of algorithms and to enable the synthesis of new algorithms. The broad array of computer science electives (over 20 elective and seminar courses) allows students to achieve more specialization in areas of personal interest.

The Computer Science Clinic provides a way of putting many of the acquired skills into practice. Examples of recent Computer Science Clinic projects are:

- A new system for the management of rocket launch countdown clocks;
- An extensible interface for current and future insulin pumps, glucose sensors and related diabetes technology;
- A computer security tool based on the biological immune system paradigm;
- An extensible software architecture that enables satellite anomalies to be detected and displayed in visual form;
- A simulation model of the GPS ground network and verification of that model through available data;

Sponsors of Computer Science Clinic projects have included Boeing, FICO (Fair Isaac), Google, GTE, IBM, Jet Propulsion Laboratory, Los Alamos National Laboratories, LinkedIn, Microsoft, MySpace, QUALCOMM, Sandia National Laboratories, Teradyne, and The Aerospace Corporation.

The final element of the major is the Computer Science Colloquium, which features speakers drawn from both industry and academia who present results of their current research. Recent colloquium speakers have come from a variety of companies, research labs and universities.

DEGREE REQUIREMENTS. A computer science major must complete the following courses:

Computer Science Foundation

Computer Science 60. **PRINCIPLES OF COMPUTER SCIENCE**, or
Computer Science 42. **PRINCIPLES AND PRACTICE OF COMPUTER SCIENCE**
Mathematics 55. **DISCRETE MATHEMATICS**
Computer Science 70. **DATA STRUCTURES AND PROGRAM DEVELOPMENT**
Computer Science 81. **COMPUTABILITY AND LOGIC**

Computer Science Kernel

Computer Science 105. **COMPUTER SYSTEMS**
Computer Science 121. **SOFTWARE DEVELOPMENT**
Computer Science 131. **PROGRAMMING LANGUAGES**
Computer Science 140. **ALGORITHMS**

Computer Science Clinic:

Two semesters of Computer Science 183, 184: **CLINIC**

Computer Science Colloquium

Four semesters of Computer Science 195: COLLOQUIUM are required only when students are in residence at HMC. Study abroad students are excused from the colloquium requirement during their time away from the HMC campus.

Three Computer Science Electives

- Computer Science 124A. **BASICS OF USER INTERFACE DESIGN**
- Computer Science 124B. **NON-TRADITIONAL USER INTERFACE DESIGN**
- Computer Science 125. **COMPUTER NETWORKS**
- Computer Science 132. **COMPILER DESIGN**
- Computer Science 133. **DATABASES**
- Computer Science 134. **OPERATING SYSTEMS: DESIGN AND IMPLEMENTATION**
- Computer Science 135. **FILE SYSTEMS**
- Computer Science 136. **ADVANCED COMPUTER ARCHITECTURE**
- Computer Science 141. **ADVANCED TOPICS IN ALGORITHMS**
- Computer Science 142. **COMPLEXITY THEORY**
- Computer Science 143: **APPLIED ALGORITHMS**
- Computer Science 144. **SCIENTIFIC COMPUTING**
- Computer Science 147. **COMPUTER SYSTEMS PERFORMANCE ANALYSIS**
- Computer Science 151. **ARTIFICIAL INTELLIGENCE**
- Computer Science 152. **NEURAL NETWORKS**
- Computer Science 153. **COMPUTER VISION**
- Computer Science 154. **ROBOTICS**
- Computer Science 155. **COMPUTER GRAPHICS**
- Computer Science 156. **PARALLEL AND REAL-TIME COMPUTING**
- Computer Science 157. **COMPUTER ANIMATION**
- Computer Science 158. **MACHINE LEARNING**
- Computer Science 159. **NATURAL LANGUAGE PROCESSING**
- Computer Science 160. **INFORMATION RETRIEVAL**

Students may substitute electives in one or more computer science-related areas, such as in engineering or mathematics, with the consent of their faculty advisor. Computer Science 186 (Computer Science Research II) can be counted as an elective for the major and requires Computer Science 185 (Computer Science Research I) as a prerequisite. Other research or project courses cannot normally be counted as electives for the major.

CONCENTRATION IN COMPUTER ENGINEERING

Students frequently ask about the possibility of pursuing a computer engineering major at HMC. As the Department of Engineering offers a non-specialized engineering degree, students interested in computer engineering may wish to major in computer science. While the courses offered in the Computer Science Department are focused primarily on systems and software, appropriate engineering courses may be counted toward the elective course requirements of the computer science major. In addition, the computer science major allows flexibility for taking additional electives beyond the major requirements, and these may be taken in engineering as well. Thus an HMC computer science major may graduate with a hardware or engineering emphasis. Engineering courses that are generally accepted as computer science technical electives include Engineering 85. **DIGITAL ELECTRONICS AND COMPUTER ENGINEERING**; Engineering 115. **PROJECT MANAGEMENT**; Engineering 151. **ENGINEERING ELECTRONICS**; Engineering 155. **MICROPROCESSOR-BASED SYSTEMS: DESIGN AND APPLICATIONS**; Engineering 161. **COMPUTER IMAGE PROCESSING AND ANALYSIS**; and Engineering 158. **INTRODUCTION TO CMOS VLSI DESIGN**.

COMPUTER SCIENCE MAJORS FROM THE OTHER CLAREMONT COLLEGES

Pomona College offers an undergraduate major in computer science; there is close cooperation between the Pomona and HMC Computer Science Departments.

HMC welcomes computer science majors from the other Claremont Colleges. Students from the other colleges who desire to major in computer science at Harvey Mudd College should inform the chair of the Computer Science Department of their plans so that they may be assigned an appropriate advisor.

The HMC Computer Science major assumes significant material included in the HMC Technical Core. In particular, it is assumed that students have taken courses in calculus, linear algebra and differential equations. Part of the advising process for an off-campus student involves identifying the courses that the student should take before enrolling in HMC computer science courses.

COMPUTER SCIENCE COURSES

0. INTRODUCTION TO COMPUTING AND PROGRAMMING (3)

Erlinger. An introduction to computing using Python and multi-media. Students will be able to read, understand, modify, and assemble programs that achieve useful communication tasks: Image manipulation, sound synthesis and editing, text (e.g., HTML) creation and manipulation, and digital video effects. Students will learn useful computing skills, including database concept. Not open to HMC students. (Fall)

5. INTRODUCTION TO COMPUTER SCIENCE (3)

Alvarado, Dodds, Kuenning, Libeskind-Hadas. Introduction to elements of computer science. Students learn general computational problem-solving techniques and gain experience with the design, implementation, testing and documentation of programs in a high-level language. In addition, students learn to design digital devices, understand how computers work, and learn to program a computer in its own machine language. Finally, students are exposed to ideas in computability theory. The course includes discussions of societal and ethical issues related to computer science. (Fall)

5GR. INTRODUCTION TO BIOLOGY AND COMPUTER SCIENCE (3)

Dodds, Libeskind-Hadas, Bush (Biology). This course introduces fundamental concepts from the Core courses Computer Science 5 and Biology 52 in a single, one-semester, integrated course. Students see both the intellectual and practical connections between these two disciplines and write computer programs to explore biological phenomena. Biology topics include the basics of biochemistry, the central dogma, population genetics, molecular evolution, metabolism, regulation, and phylogenetics. Computer science material includes basic data types and control structures, recursion, dynamic programming, and an introduction to automata and computability. Restricted enrollment to first-year students. (Fall)

Note: This course covers a sufficiently large fraction of material in Biology 52 and Computer Science 5 that students completing this course are prepared for the next courses in both the computer science and biology sequences. Additionally, this course offers students a flexible way of completing the biology and computer science portions of the Core curriculum. Completion of this course and one additional biology course (numbered higher than 52) OR one additional computer science course (numbered 60 or higher) suffices to complete the biology AND computer science portions of the Core. The second computer science or biology course cannot be double-counted towards the requirements for a major.

10. INTRODUCTION TO GAME DEVELOPMENT (3)

Sweedyk. Students learn to design and develop 2D computer games. Students are exposed to core computer science topics including data structures, artificial intelligence algorithms, computer graphics, software architecture and design, user interface design and computer simu-

lation. The course culminates in a team game project in which students learn to use modern software project management practices and principles. Cannot be used as a Computer Science or Joint Computer Science and Mathematics technical elective. Prerequisites: Computer Science 0, 5, 5GR or 42. (Spring)

42. PRINCIPLES AND PRACTICE OF COMPUTER SCIENCE (3)

Alvarado, Keller. Accelerated breadth-first introduction to computer science as a discipline for students (usually first-year) who have some programming background. Computational models of functional, object-oriented and logic programming. Data structures and algorithm analysis. Computer logic and architecture. Grammars and parsing. Regular expressions. Computability. Extensive practice constructing applications from principles, using a variety of languages. Successful completion of this course satisfies the Computer Science 5 Core requirement and Computer Science 60 coursework (formerly called Computer Science 65). Prerequisite: permission of instructor. (Fall)

60. PRINCIPLES OF COMPUTER SCIENCE (3)

Alvarado, Dodds, Keller, Libeskind-Hadas. Introduction to principles of computer science. Information structures, functional programming, object-oriented programming, grammars, logic, logic programming, correctness, algorithms, complexity analysis, finite state machines, basic processor architecture and theoretical limitations. Those who have completed Computer Science 42 cannot take Computer Science 60. Prerequisites: Computer Science 5 and one semester of calculus. (Fall and Spring)

70. DATA STRUCTURES AND PROGRAM DEVELOPMENT (3)

Kuening, O'Neill, Stone. Abstract data types including priority queues, dynamic dictionaries and disjoint sets. Efficient data structures for these data types, including heaps, self-balancing trees and hash tables. Analysis of data structures including worst-case, average-case and amortized analysis. Storage allocation and reclamation. Secondary storage considerations. Extensive practice building programs for a variety of applications. Prerequisites: Computer Science 60 or 42. (Fall and Spring)

81. COMPUTABILITY AND LOGIC (3)

Keller, Stone, Sweedyk, Bull (Pomona). An introduction to some of the mathematical foundations of computer science, particularly logic, automata and computability theory. Develops skill in constructing and writing proofs, and demonstrates the applications of the aforementioned areas to problems of practical significance. Prerequisites: Computer Science 60 or 42, Mathematics 55. (Fall and Spring)

105. COMPUTER SYSTEMS (3)

Erlinger, Kuening, Bull (Pomona). An introduction to computer systems. In particular the course investigates data representations, machine level representations of programs, processor architecture, program optimizations, the memory hierarchy, linking, exceptional control flow (exceptions, interrupts, processes and Unix signals), performance measurement, virtual memory, system-level I/O and basic concurrent programming. These concepts are supported by a series of hands-on lab assignments. Prerequisite: Computer Science 70. (Fall and Spring)

121. SOFTWARE DEVELOPMENT (3)

Keller, Sweedyk. Introduction to the discipline concerned with the design and implementation of software systems. The course presents a historical perspective on software development practice and explores modern, agile techniques for eliciting software requirements, designing and implementing software architecture and modules, robust testing practices, and project management. Student teams design, develop and test a substantial software project. Prerequisite: Computer Science 70. (Fall and Spring)

124A. BASICS OF USER INTERFACE DESIGN (1.5)

Alvarado. This course introduces students to issues in the design, implementation and evaluation of human-computer interfaces, with emphasis on user-centered design and graphical interfaces. Students will learn basic skills that aid them in choosing the right user interaction technique and developing an interface that is well-suited to the people for whom it is designed. Prerequisite: Computer Science 5, 5GR or 42. (Spring, alternate years)

124B. NON-TRADITIONAL USER INTERFACE DESIGN (1.5)

Alvarado. As computers move off of the desktop, interfaces are moving away from the traditional windows, icon, menu, pointer (WIMP) paradigm. This course builds on the basic ideas from Computer Science 124A to examine the technological and usability issues in constructing non-traditional (i.e., non-WIMP) interfaces. Styles of interfaces examined may include speech and natural language-based interfaces, tangible interfaces, vision-based interfaces and pen-based interfaces. Prerequisites: Computer Science 60 or 42, and Computer Science 124A. (Spring, alternate years)

125. COMPUTER NETWORKS (3)

Erlinger. Principles and analysis techniques for internetworking. Analysis of networking models and protocols. Presentation of computer communication with emphasis on protocol architecture. Prerequisite: Computer Science 105. (Fall)

131. PROGRAMMING LANGUAGES (3)

O'Neill, Stone, Bruce (Pomona). A thorough examination of issues and features in language design and implementation including language-provided data structuring and data-typing, modularity, scoping, inheritance and concurrency. Compilation and run-time issues. Introduction to formal semantics. Prerequisite: Computer Science 70 and 81. (Fall and Spring)

132. COMPILER DESIGN (3)

Stone. The design and implementation of compilers. Topics include elegant theoretical results underlying compilation techniques, practical issues in efficient implementation of programming languages, and bit-level interactions with operating systems and computer architectures. Over the course of the semester, students build a working compiler. Prerequisites: Computer Science 105 and 131 or permission of instructor. (Spring, alternate years)

133. DATABASES (3)

Keller. Fundamental models of databases: entity-relationship, relational, deductive, object-oriented. Relational algebra and calculus, query languages. Data storage, caching, indexing and sorting. Locking protocols and other issues in concurrent and distributed databases. Prerequisites: Computer Science 70 and 81; 131 recommended. (Fall, alternate years)

134. OPERATING SYSTEMS: DESIGN AND IMPLEMENTATION (3)

O'Neill. Design and implementation of operating systems, including processes, memory management, synchronization, scheduling, protection, file systems and I/O. These concepts are used to illustrate wider concepts in the design of other large software systems, including simplicity; efficiency; event-driven programming; abstraction design; client-server architecture; mechanism vs. policy; orthogonality; naming and binding; static vs. dynamic, space vs. time, and other trade-offs; optimization; caching; and managing large code bases. Group projects provide experience in working with and extending a real operating system. Prerequisite: Computer Science 105. (Spring, alternate years)

135. FILE SYSTEMS (3)

Kuening. Computer storage and file systems. Characteristics of nonvolatile storage, including magnetic disks and solid-state memories. RAID storage. Data structures used in file systems. Performance, reliability, privacy, replication and backup. A major portion of the course is devoted to readings selected from current research in the field. Prerequisites: Computer Science 105. (Fall, alternate years)

136. ADVANCED COMPUTER ARCHITECTURE (3)

Kuening. Reduced vs. complex instruction-set architecture, pipelining, instruction-level parallelism, superscalar architectures, advanced memory-hierarchy design, advanced computer arithmetic, multiprocessor systems, cache coherence, interconnection networks, performance analysis and case studies. Prerequisite: Computer Science 105. (Spring, alternate years)

140. ALGORITHMS (3) (Also listed as Mathematics 168)

Libeskind-Hadas, Pippenger (Mathematics), Chen (Pomona). Algorithm design, analysis, and correctness. Design techniques including divide-and-conquer and dynamic programming. Analysis techniques including solutions to recurrence relations and amortization. Correctness techniques including invariants and inductive proofs. Applications including sorting and searching, graph theoretic problems such as shortest path and network flow, and topics selected from arithmetic circuits, parallel algorithms, computational geometry, and others. An introduction to computational complexity, NP-completeness, and approximation algorithms. Proficiency with programming is expected as some assignments require algorithm implementation. Prerequisite: Computer Science 70 and Mathematics 55; Computer Science 81 recommended. (Students taking the course as Mathematics 168 have slightly different prerequisites.) (Fall and Spring)

141. ADVANCED TOPICS IN ALGORITHMS (3)

Libeskind-Hadas. Advanced topics in the design and analysis of combinatorial algorithms. Example topics are amortized analysis of data structures, competitive analysis of on-line algorithms, matroid theory, and introduction to parallel and distributed algorithms. A significant component of the course is written and oral student presentations of material from the original literature. Prerequisite: Computer Science 140/Mathematics 168. (Fall, alternate years)

142. COMPLEXITY THEORY (3) (Also listed as Mathematics 167)

Libeskind-Hadas, Pippenger (Mathematics). Brief review of computability theory through Rice's Theorem and the Recursion Theorem followed by a rigorous treatment of complexity theory. The complexity classes P, NP, and the Cook-Levin Theorem. Approximability of NP-complete problems. The polynomial hierarchy, PSPACE-completeness, L and NL-completeness, #P-completeness. IP and Zero-knowledge proofs. Randomized and parallel complexity classes. The speedup, hierarchy and gap theorems. Prerequisite: Computer Science 81. (Fall, alternate years)

143. APPLIED ALGORITHMS (3)

Libeskind-Hadas. What role do algorithms play in solving real world problems? In this class we will consider general problem solving techniques, dealing with NP-completeness, and issues concerning implementation and evaluation. The topics examined may be motivated by problems in areas such as computational biology, scientific computing, and networks. There will be a research-oriented final project. Prerequisite: Computer Science 140. (Alternate years)

144. SCIENTIFIC COMPUTING (3) (Also listed as Mathematics 164)

de Pillis (Mathematics), Yong (Mathematics). Computational techniques applied to problems in the sciences and engineering. Modeling of physical problems, computer implementation, analysis of results; use of mathematical software; numerical methods chosen from: solutions of linear and nonlinear algebraic equations, solutions of ordinary and partial differential equations, finite elements, linear programming, optimization algorithms and fast Fourier transforms. Prerequisites: Mathematics 64/64A and Computer Science 60 or 42. (Spring)

147. COMPUTER SYSTEMS PERFORMANCE ANALYSIS (3)

Kuening. Measurement and analysis of computer software and systems performance, with emphasis on methodological issues. Measurement planning and experimental design. Statistical methods for data analysis. Hypothesis testing. Effective graphical and tabular presentation of

data. Common errors in performance measurement. Elementary queuing theory. Simulation methods. Project in performance measurement. Typical projects include measurement of databases, theorem provers, file systems, networks, OS kernels and computer processors. Prerequisites: Mathematics 62/35 and Computer Science 70. (Spring, alternate years)

151. ARTIFICIAL INTELLIGENCE (3)

Alvarado, Sood (Pomona). This course presents a general introduction to the field of Artificial Intelligence. It examines the question: 'What does (will) it take for computers to perform human tasks?' It presents a broad introduction to topics such as knowledge representation, search, learning and reasoning under uncertainty. For each topic, it examines real-world applications of core techniques to problems which may include game playing, text classification and visual pattern recognition. Prerequisites: Computer Science 60 and Mathematics 62/35; Computer Science 70 recommended. (Fall and Spring)

152. NEURAL NETWORKS (3)

Keller. Modeling, simulation and analysis of artificial neural networks and their relation to biological networks. Design and optimization of discrete and continuous neural networks. Back propagation and other gradient descent methods. Hopfield and Boltzmann networks. Unsupervised learning. Self-organizing feature maps. Applications chosen from function approximation, signal processing, control, computer graphics, pattern recognition, time-series analysis. Relationship to fuzzy logic, genetic algorithms and artificial life. Prerequisites: Computer Science 60 or 42/65 and Mathematics 63/65. (Fall)

153. COMPUTER VISION (3)

Alvarado, Dodds. Computational algorithms for visual perception. Image acquisition, image processing, segmentation. Representation of color, shading, texture, shape. Stereo and motion analysis. Object recognition. Relations to robotics, human perception, image databases. Prerequisite: Computer Science 70. (Fall, alternate years)

154. ROBOTICS (3)

Dodds. Introduction to robotics from a behavioral perspective. Topics span from sensor operation and low-level actuator control to architectures and algorithms for accomplishing tasks. The basic framework and analysis of both industrial and biologically-motivated robots are addressed. The laboratory component of the class provides experience in developing algorithms, programming and testing a range of robot behaviors on our hardware platforms. Prerequisites: Computer Science 70 or permission of instructor. (Spring)

155. COMPUTER GRAPHICS (3)

Sweedyk. This course introduces students to modern computer graphics. Topics include image processing, ray tracing and pipeline rendering, GPU processing, and 3D modeling. The course also covers a selection of recent research results. Students work on four substantial projects across the semester. Prerequisites: Computer Science 70 and Mathematics 25B. (Fall)

156. PARALLEL AND REAL-TIME COMPUTING (3)

Keller, Chen (Pomona). Characteristics and applications for parallel and real-time systems. Specification techniques, algorithms, architectures, languages, design and implementation. Prerequisites: Computer Science 105 and 140; Computer Science 131 recommended. (Spring, alternate years)

157. COMPUTER ANIMATION (3)

Sweedyk. This course introduces students to the theory and practice of computer animation. The course covers the algorithms and data structures for building and animating articulated figures and particle systems including interpolation techniques, deformations, forward and inverse kinematics, rigid body dynamics, and physically based modeling. In addition, the course surveys the art, history and production of animation. Prerequisite: Computer Science 155. (Spring, alternate years)

158. MACHINE LEARNING (3)

Alvarado. An exploration of concepts and methods in machine learning including decision trees, Markov models and neural networks. Students will implement machine learning methods, read and discuss contemporary research articles in the space, and independently propose, research and implement a machine learning approach to a modern artificial intelligence problem. Prerequisites: Computer Science 151. (Fall, alternate years)

159. NATURAL LANGUAGE PROCESSING (3)

Stone. An introduction to the fundamental concepts and ideas in natural language processing, sometimes called computational linguistics. The goals of the field range from text translation and understanding to enabling humans to converse with robots. We will study language processing starting from the word level to syntactic structure to the semantic meaning of text. Approaches include statistical as well as symbolic methods using logic and the lambda calculus. Students will build and modify systems and will use large existing corpora for validating their systems. Prerequisites: Computer Science 81. (Spring, alternate years)

160. INFORMATION RETRIEVAL (3)

Keller. This course will explore how search engines work, covering text processing, index construction, text similarity, evaluation and searching other media. In addition, we will examine other applications relevant to search, including language modeling, clustering, classification and e-commerce. The course is project driven and we will build a functioning search engine. Prerequisites: Computer Science 60 or 42. (Spring, alternate years)

181, 182. COMPUTER SCIENCE SEMINAR (3)

Staff. Advanced topics of current interest in computer science. Prerequisite: Permission of instructor. (Fall and Spring)

183, 184. COMPUTER SCIENCE CLINIC I, II (3)

Staff. Team project in computer science, with corporate affiliation. Prerequisite: Computer Science 121. (Fall and Spring)

185. COMPUTER SCIENCE RESEARCH I (2-3)

Staff. An independent research project under faculty supervision. The course also has regular class meetings that address research methods and presentation skills. Prerequisite: permission of instructor. (Fall)

186. COMPUTER SCIENCE RESEARCH II (3)

Staff. A continuation of independent research carried out in Computer Science 185 culminating in a research paper and oral presentation. Prerequisite: Computer Science 185. (Spring)

189. PROGRAMMING PRACTICUM (1)

Dodds, Stone. This course is a weekly programming seminar, emphasizing efficient recognition of computational problems and their difficulty, developing and implementing algorithms to solve them, and the testing of those implementations. Attention is given to the effective use of programming tools and available libraries, as well as to the dynamics of team problem-solving. Prerequisite: Computer Science 5, 5GR or 42 or permission of instructor. (May be repeated for elective credit up to three times.) (Fall and Spring)

191, 192. COMPUTER SCIENCE PROJECT I, II (1-3)

Staff. Participation in projects of substantial interest to computer scientists. Emphasis is on the design and implementation of computer systems for real problems. Students typically work in small teams with faculty supervision. Prerequisite: permission of instructor. (Fall and Spring)

195. COMPUTER SCIENCE COLLOQUIUM (0.5)

Staff: Oral presentations and discussions of selected topics, including recent developments in computer science. Participants include computer science majors, Clinic participants, faculty members and visiting speakers. Required for all junior and senior computer science majors, any semester while in residence at HMC. No more than 2.0 units of credit can be earned for colloquia. Pass/No Credit grading. All majors welcome. (Fall and Spring)

197, 198. ADVANCED PROBLEMS IN COMPUTER SCIENCE (1-3)

Staff: Independent study in a field agreed upon by student and a faculty member. Prerequisite: permission of instructor. (Fall and Spring)

ENGINEERING

Professors Durón (Chair), Bassman, Baumgaertner, Bright, Cardenas, Cha, Dym, Furuya (2010–2011), D. Harris, S. Harris, Hightower, King, Lape, Little, Molinder, Orwin, Remer, Spjut, Wang and Yang.

PROGRAM EDUCATIONAL OBJECTIVES:

- Produce graduates who are exceptionally competent engineers whose work is notable for its breadth and its technical excellence;
- Provide a hands-on approach to engineering so that graduates develop an understanding of engineering judgment and practice;
- Prepare and motivate students for a lifetime of independent, reflective learning;
- Produce graduates who are fully aware of the impact of their work on society, both nationally and globally;
- Offer a curriculum that is current, exciting and challenging for both students and faculty, but can be completed in four years by any motivated student who is admitted to HMC.

Based on the premise that design is the distinguishing feature of engineering, the HMC engineering program provides a broad-based, hands-on experience in engineering practice and synthesis, as well as in analysis. Thus, the engineering program is designed to prepare graduates for professional practice, for advanced study in a specific engineering discipline, and for a lifetime of independent learning. Culminating in an unspecialized bachelor's degree, the program emphasizes an interdisciplinary approach to problem solving.

The engineering curriculum can be described as having three stems. The **engineering science stem** consists of five required courses (Engineering 82, 83, 84, 85 and 106) that collectively embody the fundamental “applied science” knowledge base needed by a broadly educated engineer practicing in the foreseeable future.

The **systems stem** is a sequence of three required courses (Engineering 59, 101, 102) that provides analysis and design tools to model and interpret the behavior of general engineering systems. The sequence is multidisciplinary in approach, enabling students to gain a unified view of the entire spectrum of engineering disciplines.

The **design and professional practice stem** includes five required courses that focus on working in teams on open-ended, externally-driven design projects that, over the course of the curriculum, encompass conceptual design, preliminary (or embodiment) design, and detailed design. Hands-on exposure to professional practice begins with students undertaking challenging design problems in the first year with an introduction to conceptual design, engineering drawings, and manufacturing techniques, (Engineering 4), continues with a laboratory course in experimental engineering (Engineering 80), and culminates with three semesters of Engineering Clinic (Engineering 111-113).

Pioneered by the Department of Engineering at Harvey Mudd College in 1965, the **Engineering Clinic** brings together teams of students to work with faculty advisors and external liaison engineers on carefully selected, industry- and government-sponsored design and development projects. The students plan and execute their projects; the faculty advise, coach, monitor, evaluate and provide feedback; the sponsors' liaisons ensure that the sponsors' goals are achieved and that the design experience corresponds as closely as possible to what engineers encounter in actual practice. Thus, the questions and problems that student teams face are typical of those regularly confronted by practicing engineers, and the solutions they devise must work in practice, not just in theory.

We believe that our broad engineering program graduates engineers capable of adapting changing technologies to expanding human needs, while at the same time being sensitive to the impact of their work on society. In this context, an engineering major may choose

to emphasize a particular engineering specialty by appropriate choice of elective courses and Engineering Clinic projects. Specific programs tailored to individual needs are developed in consultation with an engineering faculty advisor.

An engineering major must satisfactorily complete the following required courses for the bachelor's degree: Engineering 4, 59, 72, 80, 82, 83, 84, 85, 101–102, 106, 111–113 and 121–124. In addition, three upper-division engineering technical electives are also required and seniors must submit a final Clinic report that is acceptable to the project's faculty advisor. Students should note that many electives are offered in alternate years.

To keep the option open for majoring in engineering, a student should have taken Engineering 4 and 59 before the fourth semester. Any proposed variation from this program must be discussed in advance with an engineering advisor.

ENGINEERING COURSES

4. INTRODUCTION TO ENGINEERING DESIGN AND MANUFACTURING (4)

Staff. Design problems are, typically, open-ended and ill-structured. Students work in small teams applying techniques for solving design problems that are, normally, posed by not-for-profit clients. The project work is enhanced with lectures and reading on design theory and methods, and introduction to manufacturing techniques, project management techniques and engineering ethics. Enrollment limited to first-year students and sophomores, or by permission of the instructor. (Fall and Spring)

11. AUTONOMOUS VEHICLES (3)

D Harris, Lape. Interdisciplinary introduction to design and programming in the context of small autonomous vehicles. Topics and activities include: energy and sustainability; applied mechanics; sensors and actuators; constructing chemical, mechanical and electrical systems; embedded software development in C; a design competition. Enrollment limited to first-year HMC students and any-year off-campus students (as space permits). (Fall)

13. ENERGY SYSTEMS ENGINEERING (3)

Hightower. This course covers the science, engineering and policies of a variety of energy technologies capable of significant growth as well as an integrated systems approach to conceptualize, model and analyze energy projects and programs. Topics include energy technologies and systems associated with stationary combustion, nuclear power, transportation, wind, photovoltaic and solar thermal. Students collaborate to choose, design and develop a novel green product to address a sustainability need. (Fall)

59. INTRODUCTION TO ENGINEERING SYSTEMS (3)

Staff. An introduction to the concepts of modern engineering, emphasizing modeling, analysis, synthesis and design. Applications to chemical, mechanical and electrical systems. Prerequisite: sophomore standing. Corequisite: Physics 51. (Fall and Spring)

72. ENGINEERING MATHEMATICS (1.5) (Also cross-listed as Mathematics 110)

Bassman, Cha, Levy (Mathematics), Yong (Mathematics). Applications of differential equations, linear algebra, and probability to engineering problems in multiple disciplines. Mathematical modeling, dimensional analysis, scale, approximation, model validation. Prerequisites: Mathematics 62 and Mathematics 64A or 65; or the equivalent. (Spring)

80. EXPERIMENTAL ENGINEERING (3)

Staff. A laboratory course designed to acquaint the student with the basic techniques of instrumentation and measurement in both the laboratory and in engineering field measurements. Emphasis on experimental problem solving in real systems. Prerequisites: Engineering 59; co-requisite: Engineering 72. (Spring)

82. CHEMICAL AND THERMAL PROCESSES (3)

Hightower, Lape. The basic elements of thermal and chemical processes, including: state variables, open and closed systems, and mass balance; energy balance, First Law of Thermodynamics for reactive and non-reactive systems; entropy balance, Second Law of Thermodynamics, thermodynamic cycles and efficiency. (Fall and Spring)

83. CONTINUUM MECHANICS (3)

Bassman. The fundamentals of modeling continuous media, including: stress, strain and constitutive relations; elements of tensor analysis; basic applications of solid and fluid mechanics (including beam theory, torsion, statically indeterminate problems and Bernoulli's principle); application of conservation laws to control volumes. (Fall and Spring)

84. ELECTRONIC AND MAGNETIC CIRCUITS AND DEVICES (2)

Wang, Yang. Introduction to the fundamental principles underlying electronic devices and applications of these devices in circuits. Topics include electrical properties of materials; physical electronics (with emphasis on semiconductors and semiconductor devices); passive linear electrical and magnetic circuits; active linear circuits (including elementary transistor amplifiers and the impact of non-ideal characteristics of operational amplifiers on circuit behavior); operating point linearization and load-line analysis; electromagnetic devices such as transformers. (Fall and Spring)

85. DIGITAL ELECTRONICS AND COMPUTER ENGINEERING (3)

D. Harris, S. Harris. This course provides an introduction to elements of digital electronics, followed by an introduction to digital computers. Topics in digital electronics include: Boolean algebra; combinational logic; sequential logic; finite state machines; transistor-level implementations; computer arithmetic; and transmission lines. The computer engineering portion of the course includes computer architecture and micro-architecture: levels of abstraction; assembly-language programming; and memory systems. The digital electronics portion of Engineering 85 may be taken by non-engineering majors as a stand-alone half course under the number Engineering 85A. (Fall and Spring)

85A. DIGITAL ELECTRONICS (1.5)

D. Harris, S. Harris. This course provides an introduction to elements of digital electronics, intended for non-engineering majors who may be interested in pursuing other advanced engineering courses that require this background. Lectures for this course coincide with lectures for the first half of Engineering 85. (Fall and Spring)

101-102. ADVANCED SYSTEMS ENGINEERING (3)

Bright, Molinder. Analysis and design of continuous-time and discrete-time systems using time domain and frequency domain techniques. The first semester focuses on the connections and distinctions between continuous-time and discrete-time signals and systems and their representation in the time and frequency domains. Topics include impulse response, convolution, continuous and discrete Fourier series and transforms, and frequency response. Current applications, including filtering, modulation and sampling, are presented and simulation techniques based on both time and frequency domain representations are introduced. In the second semester additional analysis and design tools based on the Laplace- and z-transforms are developed and the state space formulation of continuous and discrete-time systems is presented. Concepts covered during both semesters are applied in a comprehensive treatment of feedback control systems including performance criteria, stability, observability, control-lability, compensation and pole placement. Prerequisite: Engineering 59 or permission of instructor. 3 credit hours per semester. (Year-long sequence)

106. MATERIALS ENGINEERING (3)

Hightower, King, staff. Introduction to the structure, properties and processing of materials used in engineering applications. Topics include: material structure (bonding, crystalline and non-crystalline structures, imperfections); equilibrium microstructures; diffusion, nucleation, growth, kinetics, non-equilibrium processing; microstructure, properties and processing of: steel, ceramics, polymers and composites; creep and yield; fracture mechanics; and the selection of materials and appropriate performance indices. Prerequisites: Physics 51, Engineering 82 and Engineering 83 or permission of instructor. (Fall and Spring)

111. ENGINEERING CLINIC I (3)

Spjut, staff. Participation in engineering projects through the Engineering Clinic. Emphasis is on design of solutions for real problems, involving problem definition, synthesis of concepts, analysis and evaluation. Prerequisite: junior standing in engineering or permission of Clinic director. (Fall and Spring)

112-113. ENGINEERING CLINIC II-III (3)

Spjut, staff. Participation in engineering projects through the Engineering Clinic. Emphasis is on design of solutions for real problems, involving problem definition, synthesis of concepts, analysis and evaluation. Prerequisites: Engineering 4, 80 and 111 or permission of Clinic director. 3 credit hours per semester. (Fall and Spring)

114. ENGINEERING CLINIC (1-3)

Spjut, staff. A continuation of Engineering Clinic for juniors who elect a second semester. Prerequisite: permission of Clinic Director. (Spring)

115. PROJECT MANAGEMENT (3)

Little, Remer. This course teaches tools and techniques commonly used in managing engineering projects, including work breakdown structures, PERT/CPM analysis, and budgeting, forecasting and aspects of project control. It also introduces use of models and operations research techniques in selecting and assigning resources to projects. Students are required to develop and implement a work plan for a small-scale project, typically a Clinic project. (Fall)

116. COST ESTIMATION AND MODELING (3)

Remer. Principles of cost and schedule estimation and modeling for capital projects, and for estimation and budgeting of operations and maintenance of ongoing processes. Hardware and software and integrated design projects are included. Advantages and disadvantages of different estimation methods are explored. (Every other year; Spring)

117. ECONOMICS OF TECHNICAL ENTERPRISE (3) (Formerly Engineering 201)

Remer. Time value of money, interest rates, depreciation and depletion, personal and corporate taxes, investment yardsticks such as present worth, rate of return, payback period and cost/benefit analysis, venture analysis and comparison of alternative projects, cost estimation and inflation, personal economics and investments, current business economic topics, tempering economics with judgment. (Fall)

118. ENGINEERING MANAGEMENT (3) (Formerly Engineering 202)

Little, Remer. Introduction to the concepts of modern management including the scientific, behavioral and functional schools of thought, motivational models, leadership styles, organizational structures, project management, and other areas of student interest. (Not to be substituted for any technical elective required for the major.) Prerequisite: senior standing or permission of instructor. (Spring)

119. PRELIMINARY DESIGN (3)

Staff. This course examines the general principles associated with functional analysis and preliminary design, and applies these principles to a particular design problem. Students in the course will be expected to demonstrate competency in the application of functional analysis

techniques and setting of performance specifications, design of artifacts to meet the functional specifications, and documentation of successful designs. Students will be offered a choice of several design problems which may come from one of the traditional engineering disciplines (chemical, civil, electrical, mechanical, etc.) or may cut across several boundaries. (Every other year; Fall)

121-122. ENGINEERING SEMINAR (0.5)

Staff. Weekly meetings devoted to discussion of engineering practice. Required of junior engineering majors. No more than 2.0 units of credit can be earned for department seminars/colloquia. Pass/No Credit grading. (Year-long sequence)

123-124. ENGINEERING SEMINAR (0.5)

Staff. Weekly meetings devoted to the discussion of engineering practice. Required of senior engineering majors. No more than 2.0 units of credit can be earned for department seminars/colloquia. Pass/No Credit grading. (Year-long sequence)

131. FLUID MECHANICS (3)

Bright, Cardenas. The flow of incompressible fluids. Primarily a study of momentum transport in continuous media. Included are the treatment of viscosity, the equations of continuity and of motion, and turbulence. Applications to analysis and design. Prerequisite: Engineering 83. (Fall)

132. HEAT TRANSFER (3)

Lape. A study of conduction, convection and radiation phenomena with application to selected problems in several fields of engineering. Prerequisite: Engineering 82. (Spring)

133. CHEMICAL REACTION ENGINEERING (3)

Remer, Spjut. The fundamentals of chemical reactor engineering: chemical reaction kinetics, interpretation of experimental rate data, design of batch and continuous reactors for single and multiple reactions including temperature and pressure effects, and the importance of safety considerations in reactor design. (Every other year; Fall)

134. ADVANCED ENGINEERING THERMODYNAMICS (3)

Lape, Spjut. The application of classical thermodynamics to engineering systems. Topics include power and refrigeration cycles, energy and process efficiency, real gases and non-ideal phase and chemical reaction equilibria. Prerequisite: Engineering 82. (Every other year; Spring)

136. MASS TRANSFER AND SEPARATION PROCESSES (3)

Lape. Principles of mass transfer, application to equilibrium-stage and finite-rate separation processes. Extension of design principles to multistage systems and to countercurrent differential contacting operations. Applications from the chemical processing industries and from such fields as desalination, pollution control and water reuse. Prerequisite: Engineering 82. (Every other year; Spring)

138. INTRODUCTION TO ENVIRONMENTAL ENGINEERING (3)

Cardenas. Introduction to the main concepts and applications in modern environmental engineering. Included are surface and groundwater pollution (both classical pollutants and toxic substances); risk assessment and analysis; air pollution; and global atmospheric change. (Every other year; Spring)

140. INTRODUCTION TO COMPRESSIBLE FLOW (3)

Cardenas. The effects of compressibility in the governing integral and differential equations for fluids. The effects of friction, heating and shock waves in steady one-dimensional flow. Unsteady wave motion and the method of characteristics. Two-dimensional flow over air foils, linearized potential flow and the method of characteristics for supersonic flow. Prerequisite: Engineering 131. (Every other year; Spring)

151. ENGINEERING ELECTRONICS (3)

Yang. Analysis and design of circuits using diodes, bipolar junction transistors and field-effect transistors, following a brief treatment of solid state electronics and the physics of solid state devices. Analysis and design of single and multi-transistor linear circuits including operational amplifiers. Corequisite: Engineering 153. Prerequisite: Engineering 59 and Engineering 84 or permission of instructor. (Fall)

153. ELECTRONICS LABORATORY (1)

Baumgaertner. Experimental evaluation of electronic devices and circuits. Prerequisite: Engineering 84 or permission of instructor; taken concurrently with Engineering 151. (Fall)

155. MICROPROCESSOR-BASED SYSTEMS: DESIGN AND APPLICATIONS (4)

D. Harris, S. Harris. Introduction to digital design using programmable logic and microprocessors. Combinational and sequential logic. Finite state machines. Hardware description languages. Field programmable gate arrays. Microcontrollers and embedded system design. Students gain experience with complex digital system design, embedded programming, and hardware/software trade-offs through significant laboratory and project work. Prerequisites: Engineering 85 or Engineering 85A and Computer Science 60 or permission of instructor. (Fall)

156. INTRODUCTION TO COMMUNICATION AND INFORMATION THEORY (3)

Molinder. Comprehensive treatment of explicit and random signal transmission through linear communication networks by generalized harmonic analysis including signal sampling and modulation theories. Treatment of noise in communication systems including design of optimum linear filters and systems for signal detection. Introduction to information theory including the treatment of discrete noiseless systems, capacity of communication channels and coding processes. Prerequisite: Engineering 101. (Spring)

158. INTRODUCTION TO CMOS VLSI DESIGN (3)

D. Harris. Introduction to digital integrated system design. Device and wire models, gate topologies, logical effort, latching, memories and timing. Structured physical design and CAD methodology. Final team project involves design and fabrication of custom chips. Prerequisites: Engineering 84 and Engineering 85A or permission of instructor. (Spring)

159. ENGINEERING ELECTROMAGNETICS (3)

Staff. Analysis of electrostatic systems, magnetostatic systems, Maxwell's equations, eddy current systems, transmission lines, radar, wave guides and antennae. Prerequisite: Physics 51. (Every other year; Fall)

161. COMPUTER IMAGE PROCESSING AND ANALYSIS (3)

Wang. An introduction to both image processing, including acquisition, enhancement and restoration; and image analysis, including representation, classification and recognition. Discussion on related subjects such as unitary transforms, and statistical and neural network pattern recognition methods. Project oriented. Prerequisites: Engineering 101-102 and programming proficiency, or permission of instructor. (Every other year; Fall)

164. INTRODUCTION TO BIOMEDICAL ENGINEERING (3)

Orwin. The application of engineering principles to help pose and solve problems in medicine and biology. Focus on different aspects, particularly biomedical measurements, bio systems analysis, biomechanics and biomaterials. (Every other year; Spring)

166. HIGH-SPEED PC BOARD DESIGN (3)

S. Harris. This course provides the student exposure to fundamental and practical issues in the design and fabrication of printed circuit boards (PCBs), with primary emphasis on boards for high-speed digital circuits. Students work in teams to design a high-speed PCB, which can then be fabricated and subsequently tested by the students. Upon completing this course,

students should be able to use appropriate CAD tools to capture a circuit schematic, choose a board cross-section, place components on a board and route wiring. Further, the course should enable students to recognize when circuit speed/size combinations are likely to make “high-speed effects” such as reflections and cross talk important, know how to quantify these effects and their impact on performance, and to design their boards to reduce the deleterious effects to an acceptable level. Prerequisites: Engineering 84 and Engineering 85A. (Every other year; Spring)

168A. INTRODUCTION TO FIBER OPTIC COMMUNICATION SYSTEMS (3)

Yang. This course provides the fundamentals of optics and its applications in communication systems. The physical layer of optical communication systems will be emphasized. Topics include optical materials; dispersion and nonlinear effects; polarization and interference; and the basic elements of system implementation such as laser sources, optical amplifiers and optical detectors. The course will include a multiple channel system design. (Every other year, Spring)

171. DYNAMICS OF ELASTIC SYSTEMS (3)

Cha. Free and forced response of single- degree-of-freedom systems. Eigenvalue problem for multi-degree-of-freedom systems; natural modes of free vibration. Forced response of undamped and viscously damped, multi-degree-of-freedom systems by modal analysis. Prerequisite: Engineering 83. (Fall)

172. STRUCTURAL MECHANICS (3)

Bassman, Dym. Introduction to elementary structural systems: trusses, beams. Force and deflection analysis. Energy methods. Stability. Introduction to finite element methods. Prerequisite: Engineering 83. (Spring)

173. APPLIED ELASTICITY (3)

Dym. Introduction to the concepts of stress and strain. Application to the theory of bending and torsion. Topics in elementary elasticity. Prerequisite: Engineering 83. (Every other year; Fall)

174. PRACTICES IN CIVIL ENGINEERING (3)

Little, Cardenas, Dym. The student is exposed to the practice of civil engineering through a series of case studies discussed within the context of a broad-based engineering curriculum. Engineering fundamentals related to the selection and use of construction materials, stress and strain, and to the analysis and design of structural and transportation systems may be discussed. Types and specifics of case studies vary depending upon the instructor. Prerequisites: Engineering 59, Engineering 80 and permission of the instructor. (Every other year; Spring)

175. RIGID BODY DYNAMICS (3)

Bassman. Kinematics, mass distribution and kinetics of systems of particles and rigid bodies. Formulation of equations of motion with: Newton/Euler equations; angular momentum principle; power, work and energy methods. Numerical solutions of nonlinear algebraic and ordinary differential equations governing the behavior of multiple degree of freedom systems. Computer simulation of multi-body dynamic systems. Construction of physical systems for comparison with simulation. Prerequisite: Engineering 83 (taken previously or concurrently). (Fall)

176. NUMERICAL METHODS IN ENGINEERING (3)

Cha. This course focuses on the application of a variety of mathematical techniques to solve real-world problems that involve modeling, mathematical and numerical analysis, and scientific computing. Concepts, calculations and the ability to apply principles to physical problems are emphasized. Ordinary differential equations, linear algebra, complex analysis, numerical methods, partial differential equations, probability and statistics, etc., are among the techniques that would be applied to problems in mechanical, electrical, chemical and civil engineering. Examples are drawn from fluid mechanics, heat transfer, vibration of struc-

tures, electromagnetics, communications and other applied topics. Program development and modification are expected as well as learning to use existing code. Prerequisite: Engineering 72. (Every other year; Spring)

179. DEFORMATION AND FRACTURE OF SOLIDS (3)

King. Elements of stress and strain, elastic and plastic deformations of solid materials, fracture mechanics, strengthening mechanisms, thermal and thermo-mechanical processing, effects of microstructure, failure modes and analysis of service failures. Prerequisites: Engineering 83 and 106. (Every other year; Fall)

190. SPECIAL TOPICS IN ENGINEERING (3)

Staff. An upper division or graduate technical elective treating topics in engineering not covered in other courses, chosen at the discretion of the Engineering Department.

191. ADVANCED PROBLEMS IN ENGINEERING (1-3)

Staff. Independent study in a field agreed upon by student and instructor. Credit hours to be arranged.

205. SYSTEMS SIMULATION (3)

Bright, Molinder. An examination of the use of high-speed digital computers to simulate the behavior of engineering and industrial systems. Both continuous and discrete systems are treated. Prerequisites: Engineering 101-102. (Fall)

206. OPTIMIZATION TECHNIQUES IN ENGINEERING DESIGN (3)

Bright, Dym, Little. Presentation of techniques for making optimum choices among alternatives; applications to engineering design problems. Prerequisite: Engineering 205. (Spring)

231. ADVANCED TRANSPORT PHENOMENA (3)

Bright, Lape. Integrated approach to the subjects of fluid mechanics, heat transfer and mass transfer, through the study of the governing equations common to all three fields. Applications drawn from a wide variety of engineering systems. Prerequisite: Engineering 131. (Spring)

278. ADVANCED STRUCTURAL DYNAMICS (3)

Cha. Free and forced response of continuous systems, including the vibration of strings, rods, shafts, membranes, beams and plates. One dimensional finite element methods: discretization of a continuum, selection of interpolation functions, and determining the element mass and stiffness matrices and the corresponding load vector. Introduction to special topics, including the effects of parameter uncertainties on the dynamics of periodic structures and model updating in structural dynamics. Prerequisite: Engineering 171. (Every other year; Spring)

HUMANITIES, SOCIAL SCIENCES AND THE ARTS

Professors Wright (Chair), Alves, Balseiro, Barron, Beckman (emeritus), Cubek, de Laet, Dyson, Evans, Groves, Kamm, Lamkin (emeritus), Mashek, Mayeri, Olson, Steinberg, Sullivan and Tan.

Website: hmc.edu/academics/clinicresearch/academicdepartments/humanitiesandsocialsciences.html

As a liberal arts college, HMC offers its curriculum in the spirit of providing a broadly based education. One reflection of that commitment is the College's Core, to which all seven academic departments contribute. Another is the program in Humanities, Social Sciences and the Arts (HSA), which each student completes along with the Core and a major. Exposure to the subjects and methods of the various HSA disciplines builds analytical skills and offers avenues for the development of increased self-knowledge, a humane concern for society, an understanding of the wider context in which science and engineering are practiced, and an examined and evolving set of values.

HSA PROGRAM

Beginning with the Class of 2014, the required program consists of HSA 10, Critical Inquiry—a Core course taken in the spring of the first year—along with a minimum of ten other HSA courses. These ten (or more) further courses must together satisfy the distribution, concentration, writing, and departmental requirements described below. A given course may be used to satisfy one or more of these requirements; e.g., the same course might count toward a student's concentration and satisfy the writing requirement. There are no prescribed courses other than HSA 10; thus, students have significant flexibility in planning their programs of study.

Distribution and concentration requirements. The distribution requirement is satisfied by taking at least one course in each of five different HSA disciplines. The concentration requirement is satisfied by taking at least four courses in a single HSA discipline or interdisciplinary field chosen from the distinct areas of liberal arts study offered at The Claremont Colleges (see the list of approved concentrations under "Advising Resources" on the HSA Department website). Together, these requirements ensure that students gain exposure to a variety of methods and perspectives within HSA, but also achieve depth and intellectual development within one area of study. Since the concentration is intended to represent progress in a field of study, even though that field might be interdisciplinary, the concentration should typically advance beyond introductory level courses. A concentration in the arts must include at least two courses that focus on theory, criticism or historical analysis. Students who intend to concentrate in areas not covered by the department's faculty should plan their program carefully in order to be able to fulfill all requirements.

Writing requirement. So that students can build on the writing skills addressed in HSA 10, at least one HSA course taken after HSA 10 must involve significant writing. Both departmental courses and HSA courses offered at the other Claremont Colleges (or outside of Claremont) can satisfy this requirement. The department's website contains a list of the departmental courses with significant writing, as well as an approval form that can be used to satisfy the writing requirement with a non-departmental HSA course. In general, a course satisfies this requirement if it assigns at least 5,000 words of formal graded writing, excluding exams, short response papers, e-mail or online discussion contributions, and in-class writing.

Departmental requirement. The department is responsible for ensuring that exploration of the humanities, the social sciences and the arts constitutes an integral component of the life of the Harvey Mudd College community. This means that HMC students and the department's faculty should explore these disciplines together to a significant extent. Accordingly, at least five of the courses required in addition to HSA 10 must be taken with departmental faculty. Remaining coursework (including any extra courses) may be done at the other Claremont Colleges, and the department encourages students to take advantage of this opportunity.

Courses offered by departmental faculty in the Joint Music Program (Professors Cubek and Kamm) count as departmental courses although they are taught at Scripps.

ADVISING

The department assigns each student an HSA advisor in the spring of the first year. Normally, a student's HSA 10 instructor fills this role. The student and the advisor meet at least once a semester with the approach of preregistration to review the student's progress in the program and plan future coursework. The HSA advisor can be helpful at other times also, such as when a student is considering dropping a course, encounters academic difficulties, or is thinking through choices regarding graduate school or career. Since the HSA program affords students significant choice, students are encouraged to plan ahead and keep in touch with their advisors from semester to semester. Students should also consult the department's *Advising Handbook* and the "Advising Resources" section of the department's website.

OTHER CONSIDERATIONS

In addition to the requirements outlined above, the department also encourages students to include in their HSA programs coursework that provides exposure to cultural diversity, and the department is committed to offering courses that meet this goal.

To facilitate academic and cultural experiences not available directly at HMC, the department waives one departmental course for students who study abroad or who concentrate in an area not regularly supported by the HSA department. However, unless transferring from another institution, a student may not take fewer than four departmental courses in addition to HSA 10.

The department tries to offer a balanced mix of courses each semester. Students may also arrange for directed readings by agreement with individual faculty members. Normally, a directed reading course is undertaken in a discipline in which the student has already taken at least one regular course.

HUMANITIES, SOCIAL SCIENCES, AND THE ARTS COURSES**HUMANITIES, SOCIAL SCIENCES, AND THE ARTS (HSA)****10. CRITICAL INQUIRY (3)**

Staff: This seminar course introduces students to inquiry, writing, and research in HSA, through focused exploration of a particular topic selected by the instructor in each section. To encourage reflection on the place of HSA within the HMC curriculum, the course begins with a brief unit on the history and aims of liberal arts education. Writing assignments include a substantial research paper on a topic of interest chosen by the student in consultation with his or her instructor. The course ends with student research presentations in each section, followed by a Presentations Days event featuring the best presentations from across all sections. (Spring)

190. SENIOR EXPERIENCE (3)

Staff: A project-oriented course, open only to seniors. Such projects may involve: internships, recitals, performances and artistic productions; independent research projects; and senior tutorials. See the *Department of Humanities, Social Sciences, and the Arts Advising Handbook* for more details. Prerequisite: departmental approval of student proposal, permission of instructor.

AMERICAN STUDIES**103. INTRODUCTION TO AMERICAN CULTURES (3)**

Staff: An interdisciplinary introduction to principal themes in American culture taught by an intercollegiate faculty team.

115. PRINT AND AMERICAN CULTURE (3)

Groves. Covers numerous developments in American print culture through the careful examination of both textbooks and artifacts (period books, magazines, newspapers, letters, diaries, advertisements and so on).

ANTHROPOLOGY**110. LIFE: KNOWLEDGE, BELIEF AND CULTURAL PRACTICES (3)**

de Laet. An exploration of cultural attitudes toward life and the human body: from Melanesian origin myths to the human genome project; from the first autopsies to cloning and genetic manipulation; from early body snatchings to the trade in bodies and body parts in the global economy. The question of what constitutes life is subject to controversy, and reveals cultural differences in practices, knowledges and beliefs. This course aims to help students develop a sophisticated and informed attitude towards cultural difference.

111. INTRODUCTION TO THE ANTHROPOLOGY OF SCIENCE AND TECHNOLOGY (3)

de Laet. An introduction to science and technology as cultural phenomena and a hands-on initiation into anthropology. While applying basic anthropological methods in the academic environment, students gain an understanding of science and technology as a culturally, socially and historically specific way of constructing knowledge. In other words, rather than taking for granted the ways in which we make knowledge, this course makes those ways “strange.”

ART**60. WORKSHOP IN HAND PRESS PRINTING (1.5)**

Groves. This workshop introduces students to the basic vocabulary and practices of typesetting, typography, and printing for and on an iron hand press. Work includes a skill-building project and a student-designed semester project. Students may repeat the course once.

171. BUILDING LOS ANGELES (3)

Groves and Petersen. This course explores the complex network of urban communities in which we live in order that we might think more deeply about the relationship of the built to the natural environment. To complicate our conceptions of Los Angeles, we will consider the city’s history and the massive infrastructure that allows it to function. We will focus for a substantial part of the course on architecture, which can be a profound expression of the relationship between the built and the natural. And we will explore contemporary developments, including adaptive re-use, the new urbanism, and green design.

ART HISTORY**158. VISUALIZING CHINA (3)**

Tan. Explores the political, social and cultural landscape of contemporary China through art (painting, sculpture/installation, photography, performance and videos). Theories of modern and postmodern art will be introduced in the analysis of visual materials.

CHINESE**1 A, B. ELEMENTARY CHINESE (3)**

Tan. First-year course in Chinese language. Students will engage in conversation, pattern drills, reading and character-writing. (1A is offered in fall; 1B in the spring.)

155. INTRODUCTION TO CONTEMPORARY CHINA (3)

Tan. This course examines a variety of issues in modern China, ranging from politics, the economy, and environmental problems to ethnicity, religion and the arts. We will briefly review the history of the People’s Republic of China and “Greater China,” but discussion will

center on the 21st century. A combination of scholarly writings, literary texts, historical documents, newspaper and journal articles, personal memoirs, photographs and films will be used as course materials.

ECONOMICS

53. PRINCIPLES OF MACROECONOMICS (3)

Evans. Provides a fundamental understanding of the national economy. Topics include theories of unemployment, growth, inflation, income distribution, consumption, savings, investment and finance markets, and the historical evolution of economic institutions and macroeconomic ideas.

54. PRINCIPLES OF MICROECONOMICS (3)

Sullivan. Provides methods of investigating the individual behavior of people, businesses and governments in a market environment. Topics include elementary models of human economic behavior and resource allocation, and the evolution of market institutions and their impact upon society.

103. THE GREAT ECONOMISTS (3)

Staff. Surveys the significant contributions of a noted economist.

104. FINANCIAL ECONOMICS (3)

Evans. The principles of money and banking from the viewpoint of both business person and banker. Topics include the operation of commercial banks, related financial institutions, the development of the banking system, international finance, governmental fiscal and monetary policy, and the relations of money and credit to prices. Prerequisite: Economics 53.

108. GOVERNMENT AND FISCAL MONETARY POLICY (3)

Evans. Includes an in-depth examination of the federal budget, deficits and the debt, budgetary enforcement, line-item spending, tax policy and theories of the impact of government economic activity upon the rest of the economy. Monetary policy emphasizes the policies and activities of the Federal Reserve System, efforts to influence interest rates, money growth and credit, and studies of policy options.

136. FINANCIAL MARKETS AND MODELING (3)

Evans. Modern financial strategy seeks to reduce market risk through the use of complex instruments called derivatives. This course introduces students to the world of futures, options and other derivatives. Topics to be covered include a survey of the markets and mathematical models of risk and volatility. Prerequisite: Economics 104 or equivalent.

140: THE ECONOMICS OF WOMEN, FAMILY AND WORK (3)

Sullivan. An introduction to research and theory in the rapidly growing field of work and family studies. Inherently interdisciplinary, the study of work/family intersections involves the literatures of sociology, anthropology, psychology, legal studies, and history, as well as economics. Topics to be considered include: the relationship between parental work and child development; the economic affects of care-giver status; gender differentials in the workplace; family-related public policy; the division of household labor, and work and health. Taught in seminar style and largely discussion-based.

142. DEVELOPMENT ECONOMICS (3)

Sullivan. A critical introduction to the major orthodox and heterodox theories of development economics and to a selection of alternative strategies. Central objectives include identification of the determinants of economic growth and the distinction of growth from development.

150. POLITICAL ECONOMY OF HIGHER EDUCATION (3)

Sullivan. An exploration of topics central to the political economy of contemporary American higher education. Organized as a seminar, the course is also a workshop in which students

develop reading lists, influence the selection of subtopics and lead discussions. Likely topics include the academic labor market, admissions and marketing issues, college sports, and the role of government funding. Particular attention will be paid to forces that shape the education of scientists, mathematicians, and engineers.

153. INTERMEDIATE MACROECONOMICS (3)

Staff. A reexamination of the principles of macroeconomics at a more advanced level. The use of formal models for macroeconomic analysis and application to topical problems. Prerequisite: Economics 53. Economics 54 is recommended but not required.

154. INTERMEDIATE MICROECONOMICS (3)

Staff. An advanced treatment of micro-economic theory using formal mathematical models for analysis. Optimization models of human behavior and resource use in a market environment are developed, analyzed and applied to a topical economic allocation problem. Prerequisite: Economics 54.

HISTORY

80. SCIENCE AND TECHNOLOGY IN THE ANCIENT AND MEDIEVAL WORLDS (3)

Olson, staff. Scientific institutions, scientific thought and technological systems from the earliest civilizations through Classical Greece and the Hellenistic world, and their continuation and transformation in Roman, Arabic and Western Medieval civilizations. Special attention given to Plato, Aristotle, Euclid and Ptolemy.

81. SCIENCE AND TECHNOLOGY IN THE EARLY MODERN WORLD (3)

Olson, staff. Scientific institutions, scientific thought and technological systems during the Scientific Revolution, from the Renaissance, the emergence of print culture, and the growth of world trade through the French and first industrial revolutions. Attention given to Paracelsus, Galileo, Descartes, Newton, Linnaeus, Lavoisier.

82. SCIENCE AND TECHNOLOGY IN THE MODERN WORLD (3)

Olson, staff. Scientific institutions, scientific thought and technological systems from the early 19th century through the mid-20th century as science and technology emerged as defining characteristics of “Western” culture. Attention given to the work and impact of Faraday, Darwin, Pasteur, Einstein, Freud and Heisenberg.

127. TWENTIETH-CENTURY U.S. HISTORY (3)

Barron. An analysis of U.S. history from the Progressive Era to the present, with particular emphasis on social, economic and cultural developments and their relationships to political change.

128. IMMIGRATION, ETHNICITY AND RACE IN THE U. S. (3)

Barron. A study of the experiences of different ethnic groups in the U.S. from the colonial period to the present that addresses the meanings of cultural diversity in American history.

131. THE JEWISH EXPERIENCE IN AMERICA (3)

Barron. A consideration of the interactions between Jews and American society from the colonial period to the present. Topics include Anti-Semitism, American responses to the Holocaust, the United States and Israel, Black-Jewish relations, and the meanings of Jewish identity in contemporary America.

132. THE CALIFORNIA EXPERIENCE (3)

Barron. An exploration of California’s history from the pre-colonial period to the present that pays special attention to the experiences of the different groups who have populated the state as well as California’s environmental history and the state’s changing political dynamics.

133. FOOD AND AMERICAN CULTURE (3)

Barron. This course investigates the social and cultural history of food in the United States. In many ways food is the quintessential “dense social fact,” and its production and consumption embody many different layers of meaning. Consequently, one of the main goals of the course is to be able to look at food in a more critical, self-conscious, and theoretically and historically informed way-to problematize something that is so prosaic that we often take it for granted.

183. SCIENCE AND TECHNOLOGY IN AMERICAN CULTURE (3)

Olson. An exploration of the ways in which science and technology have shaped the American landscape and mindscape as well as the reciprocal ways in which American contexts have directed scientific and technological developments. Covers the colonial and early modern period during which the “inventory sciences,” including botany and geology were pursued for their presumed economic benefits and during which enlightenment scientific ideas helped to shape our governmental institutions. Discussion also includes the 19th and early 20th centuries, which saw the spread of railroads, electrification and automobiles and an obsession with evolution, efficiency and eugenics. Concludes with recent themes connected with military technologies, including the atomic bomb, energy sources, environmental issues and biotechnology.

LITERATURE**103. THIRD CINEMA (3)**

Balseiro. Emerging in Latin America in the 1960s and 1970s, the notion of Third Cinema takes its inspiration from the Cuban revolution and from Brazil’s Cinema Novo. Third Cinema is the art of political film making and represents an alternative cinematic practice to that offered by mainstream film industries. Explores the aesthetics of film making from a revolutionary consciousness in three regions: Africa, Asia and Latin America.

104. AN INTRODUCTION TO MIDDLE ENGLISH LITERATURE (3)

Groves. For students interested in developing a basic ability to translate and pronounce Middle English. Works studied will include: the first fragment of Chaucer’s “The Canterbury Tales”; “Sir Orfeo”; “Sir Gawain and the Green Knight”; and selections from Malory’s “Le Morte D’Arthur.”

105. THE LAND AND AMERICAN LITERATURE (3)

Groves. Explores how landscape is depicted in American literary texts and the relationship between those texts and other modes of representation (painting, cartography, photography and film).

110. SHAKESPEARE (3)

Groves. Covers selected dramatic and lyric works by Shakespeare with some attention to other Elizabethan and Jacobean writers. Final project: a public performance of a Shakespeare play.

117. MAJOR AUTHORS (3)

Staff. An intensive study of the work and literary development of one or two major authors. Readings drawn from the authors’ works and related critical, biographical and historical texts. Specific instances are listed below.

117A. DICKENS, HARDY AND THE VICTORIAN AGE (4)

Groves, Eckert (Physics). An intensive study of the work and literary development of Charles Dickens and Thomas Hardy. Readings drawn from the authors’ works and related critical, biographical, and historical texts. Class travels to England over winter break; travel expenses are the responsibility of the student. (Fall and winter break)

144. POE GOES SOUTH: THE FANTASTIC SHORT STORY (3)

Balseiro. A consideration of Poe's influence on the development of the fantastic short story in Latin America. Topics include: Poe's reception in Europe and in the Southern Cone, Poe's influence in the literature of magic realism in 20th-century Latin America.

145. THIRD-WORLD WOMEN WRITERS (3)

Balseiro. Focuses on the relationships between gender and identity in the writings of Third-World women as well as theoretical background on Third-World feminisms. Authors include Nawal El Saadawi, Alifa Rifaat, Mariama Ba, Bessie Head, Ana Lydia Vega and Jamaica Kincaid.

146. TWENTIETH-CENTURY SOUTH AFRICAN LITERATURE (3)

Balseiro. An introduction to the interactions between literature, politics and history in 20th-century South Africa. Readings include drama, poetry, fiction and biography, as well as several films and documentaries.

147. WRITERS FROM AFRICA AND THE CARIBBEAN (3)

Balseiro. An examination of the themes of nation, exile, race and gender in works by Chinua Achebe, Wole Soyinka, Ayi Jwei Armah, Yusuf Idriss, Ngugi wa Thiong'o, Nadine Gordimer, George Lamming, Jean Rhys and Rosario Ferre, among others. Theoretical background on Third-World literature will also be covered.

155. POST-APARTHEID NARRATIVES (3)

Balseiro. This seminar maps the literary terrain of contemporary South Africa. Through an examination of prose, poetry and visual material, this course offers some of the responses writers have given to the end of apartheid, to major social events such as the hearings of the Truth and Reconciliation Commission, and to the idea of a "new" South Africa.

MEDIA STUDIES**50. LANGUAGE OF FILM (3)**

Mayeri. Introduction to film analysis, exploring the language of film through weekly screenings and discussions. The craft of filmmaking—screenwriting, cinematography, mise-en-scene, sound, editing—from silent films, to classical Hollywood cinema, to independent film, documentary, and animation. Consideration of film as an art form, as reflection of the culture at large, and as a force for change.

60. DOCUMENTARY: FACT AND FICTION (3)

Mayeri. Examines the propaganda and poetry of documentary film. In weekly screenings, students will see films on a range of topics: from ethnographic adventures with other cultures to allegorical tales about our animal relatives. This class will explore documentary craft, history, and politics, and analyze the ethics of representing others.

127. THE HARMONY OF SOUND AND LIGHT (3)

Alves. New technology has created exciting new opportunities in the arts of abstract film, video, and computer animation. This course will explore theories of abstraction from music into the visual arts and film, analyzing the works of such pioneers as Oskar Fischinger and John Whitney. Students will create their own computer images and animations of "visual music."

144. A HISTORY OF SPECIAL EFFECTS (3)

Mayeri. Hovering between reality, fantasy, and nightmare, visual illusions have enraptured the masses for hundreds of years - from St. Peter's Basilica to "The Matrix." This course will trace several intersections of art and technology—the emergence of illusionism in Renaissance painting, the origin of the proscenium theater in Baroque opera, the development of special effects before and through cinema, and into our increasingly televised and mediated public space. Using art, film, and cultural history and theory, we will analyze the social, political and aesthetic dimensions of spectacle.

170. DIGITAL CINEMA (3)

Mayeri. Intermediate/advanced video course, exploring the creative potential of digital video techniques, such as compositing, animation, and motion graphics. Students develop digital projects and participate in critiques. Lectures, discussions, and screenings enhance students' exposure to art and cinema. Prerequisite: Media Studies 182 Introduction to Video Production or equivalent.

173. EXILE IN CINEMA (3)

Balseiro. A thematic and formal study of the range of cinematic responses to the experience of exile. Exile is an event, but how does it come about and what are its ramifications? Exile happens to individuals but also to collectivities. How does it effect a change between the self and society, homeland and site of displacement, mother tongue and acquired language? This course examines how filmmakers take on an often painful historical process through creativity.

182. INTRODUCTION TO VIDEO PRODUCTION (3)

Mayeri. Students learn how to make their own videos, using professional video cameras and editing systems. Weekly, hands-on workshops will cover the entire production process—storyboarding, shooting, lighting, recording sound and editing in Final Cut Pro. Students will complete several group exercises and individual projects, and participate in critiques of professional media and each other's work. Video is explored as a medium for expression, persuasion, humor, storytelling and art-making. Prerequisite: Media Studies 50 Language of Film or Media Studies 49 Introduction to Media Studies.

MUSIC**3. FUNDAMENTALS OF MUSIC (3)**

Cubek. In this course, the student learns elementary concepts of melody, rhythm, harmony and notation. Basic principles of sight-singing and reading music are included. No previous musical experience is required. This course, or its equivalent, is a prerequisite for Music 110a (Music Theory I) at Scripps College. Carries departmental credit when taught by Cubek. (Offered each semester)

48. ELECTRONIC MUSIC ENSEMBLE (1)

Alves. Rehearsal and performance of new and recent compositions for synthesizers and other instruments. Instrumentation and musical styles may vary. Though some synthesizers may be provided, in most cases students will be expected to own their own instruments. Prerequisite: ability to play an instrument and read music. Audition may be required for instructor permission.

49. AMERICAN GAMELAN ENSEMBLE (1)

Alves. Rehearsal and performance of new compositions for instruments adapted from the gamelan, a Javanese orchestra of metallophones and gongs. No prior experience on these instruments is required. Prerequisite: Ability to read music, approval of instructor.

63. MUSIC OF THE PEOPLES OF THE WORLD (3)

Alves. The fundamentals of music and listening through a survey of traditional music around the world as well as cross-cultural influences. Neither an ability to read music nor any other background in music is required.

81. INTRODUCTION TO MUSIC: SOUND AND MEANING (3)

Alves, Cubek, Kamm. This course explores important works of Western art music from diverse historical epochs through listening and analysis. Elements of music, basic musical terminology and notation are discussed. Attention is given to the relation of the arts—especially music—to culture and society. (Carries departmental credit when taught by Alves, Cubek, or Kamm.)

84. JAZZ IMPROVISATION (1.5)

Keller (Computer Science). The art of simultaneously hearing, composing and performing music. Chords, scales, chord progressions and tunes of modern jazz. Theory, listening, analysis and group practice in improvisation skills. Prerequisites: Music reading ability, ability to play most of the 12 major scales on an instrument, motivation to play jazz, permission of the instructor. Repeatable for credit.

88. INTRODUCTION TO COMPUTER MUSIC (3)

Alves. The basics of using software on a general purpose computer to synthesize and manipulate digital sounds. Neither a background in music nor the ability to read music is required. A background in computers is helpful but not required.

117. TWENTIETH-CENTURY MUSIC (3)

Alves. An investigation of contemporary music through performances, analyses, recordings and discussions of representative compositions from late Romanticism and such 20th-century styles as Neo-classicism, Serialism and Minimalism, as well as aleatoric and electronic techniques. Prerequisite: The ability to read music. Offered in conjunction with the Joint Music Program.

132. STRAVINSKY: HIS MILIEU AND HIS MUSIC (3)

Kamm. A seminar studying Igor Stravinsky's life and his ballets, other instrumental music and vocal music. Study of Russia at the turn of the 20th century, Paris in the early 20th century, ballet and other arts contextualizes Stravinsky's music. The course includes frequent student presentations on topics and works.

173. CONCERT CHOIR (1)

Kamm. A study through rehearsal and performance of choral music selected from the 16th century to the present, with emphasis on larger, major works. Prerequisite: successful audition. (Both semesters; joint offering of CMC, HMC, Pitzer and Scripps)

174. CHAMBER CHOIR (1)

Kamm. A study of choral music from 1300 to the present, with emphasis on those works composed for performances of a choral chamber nature. Singers in Chamber Choir also sing with the Concert Choir. Prerequisite: successful audition. (Both semesters; joint offering of CMC, HMC, Pitzer and Scripps)

175. THE CLAREMONT CONCERT ORCHESTRA (1)

Cubek. The study through rehearsal, with discussion as needed, and performance, of styles and techniques appropriate for the historically accurate performance of instrumental works intended for the orchestra. Repertoire will include works from mid-18th century to the present with special emphasis on the classical and romantic periods. Prerequisite: successful audition. (Both semesters; joint offering of CMC, HMC, Pitzer and Scripps)

PHILOSOPHY**108. KNOWLEDGE, SELF AND VALUE (3)**

Wright. An introduction to philosophy covering representative issues in epistemology, the metaphysics of human nature and theory of value. Readings are drawn from historical and contemporary sources.

121. ETHICAL THEORY (3)

Wright. A survey of contemporary philosophical thinking about morality, concentrating on theories of normative ethics but with some attention to issues in metaethics. The course explores consequentialist, deontological, egoistic, and virtue-based normative theories, as well as debates about the impact of a commitment to morality on personal projects and relationships.

122. ETHICS: ANCIENT AND MODERN (3)

Wright. A comparative study of the works of several major moral philosophers, beginning in antiquity with Plato and Aristotle and ending in the nineteenth century with Nietzsche's critique of modern morality. Other figures studied include Hume, Kant and Mill, and may also include Aquinas, Hobbes or Spinoza.

124. MORALITY AND SELF-INTEREST (3)

Wright. A study of historical and contemporary arguments for the harmony of morality and enlightened self-interest, along with some of the main challenges raised against such arguments by their critics. Reading assignments may include selections from Plato, Aristotle, Sidgwick, Prichard, Ayn Rand, Rosalind Hursthouse, Derek Parfit, David Gauthier and others.

125. ETHICAL ISSUES IN SCIENCE AND ENGINEERING (3)

Wright. After briefly exploring concepts and theories in normative ethics, this course examines a representative set of ethical issues confronting researchers and practitioners in the natural and formal sciences and in engineering. Issues covered will vary but may include animal experimentation, genetic engineering, internet privacy, the responsibility of engineers to foresee and prevent harm and others.

130. POLITICAL PHILOSOPHY (3)

Wright. The major traditions of political thought, with emphasis on the modern era, including natural rights theory, social contract theory, and the philosophic foundations of political liberalism.

POLITICAL STUDIES**114. COMPARATIVE ENVIRONMENTAL POLITICS (3)**

Steinberg. An examination of the political challenges faced by environmental advocates in diverse countries around the globe. Drawing on the fields of comparative politics and public policy, topics include comparative political institutions, environmental movements, corruption, authoritarian regimes, democratization, lesson-learning across borders, policy reform, gender analysis, decentralization and European unification.

140. GLOBAL ENVIRONMENTAL POLITICS (3)

Steinberg. Analyzes the political dynamics driving global environmental problems and current attempts to address them. Concepts from political science and public policy are applied to issues such as ozone depletion, climate change, trade in endangered species, treaty formation and effectiveness, transnational activism and multi-level governance.

188. POLITICAL INNOVATION (3)

Steinberg. Under what conditions do novel political ideas become realities? Explores the origins and impacts of political innovations large and small—from the framing of the Constitution to the development of major social policies, the creation and reform of government agencies and non-profit organizations and experimentation with new forms of social protest and political mobilization.

PSYCHOLOGY**53. INTRODUCTION TO PSYCHOLOGY (3)**

Mashek. An overview of the field of psychology, its principles, content and methods. Special reference to classical studies and significant experiments.

108. INTRODUCTION TO SOCIAL PSYCHOLOGY (3)

Mashek. The study of the way individuals think about, influence and relate to one another. Sample topics include: conformity, persuasion, social cognition, self-justification, prejudice and attraction.

150. PSYCHOLOGY OF CLOSE RELATIONSHIPS (3)

Mashek. An introduction to the leading theoretical perspectives employed by social psychologists in the study of close romantic relationships. Participants will examine a number of relationship-relevant constructs (e.g., love, commitment, intimacy, breakups) through the lenses offered by these different theories.

RELIGIOUS STUDIES**105. RELIGIONS IN AMERICAN CULTURE (3)**

Dyson. An exploration of American religious history from pre-colonial indigenous civilizations through the present, focusing on three related issues: diversity, toleration and pluralism. The course asks how religions have shaped or been shaped by encounters between immigrants, citizens, indigenous peoples, tourists, and, occasionally, government agents. In relation to these encounters, the course considers how groups and individuals have claimed territory, negotiated meaning, understood each other and created institutions as they met one another in the American landscape. Attention is also given to questions of power, translation and the changing definitions of religion itself.

113. GOD, DARWIN, DESIGN IN AMERICA: A HISTORICAL SURVEY OF RELIGION AND SCIENCE (3)

Dyson. An exploration of the relationship between scientific and religious ideas in the United States from the early 19th century to the present. Starting with the Natural Theologians, who made science the “handmaid of theology” in the early Republic, we will move forward in time through the publication of Charles Darwin’s *On the Origin of Species* and Andrew Dickson White’s subsequent declaration of a war between science and religion, into the 20th century with the Scopes trial and the rise of Creationism, the evolutionary synthesis, and finally the recent debates over the teaching of Intelligent Design in public schools.

147. WORLD RELIGIONS AND TRANSNATIONAL RELIGIONS: AMERICAN AND GLOBAL MOVEMENTS (3)

Dyson. An exploration of what happens to religious practices and communities when they are transplanted to new terrain: for example, in the establishment of “old world” religious enclaves in the United States, New Age adoptions of “foreign” practices, American understandings of world religions, or the exportation of American or Americanized religion to other countries through missionaries, media or returning immigrants. Considering exchange, conflict, adaptation and innovation as multi-directional, and always historically and politically informed, the course looks at several historic and contemporary instances of religious border crossings.

183. GHOSTS AND THE MACHINES (3)

Dyson. An exploration of the interrelations between occult mediumship, modern media and technology in Europe and the United States from the nineteenth-century through the present. The aim of the course is to explore how the Enlightenment and its offspring, modern technology, in their seemingly stark material and rational promises of progress, have never rid themselves fully of the paranormal and irrational. To explore the multiple relations between ghosts and the machines, topics for the course include: ghostly visions and magic lantern phantasmagoria; American spiritualism and the telegraph; phrenology and the rise of the archive; psychical research and stage magic; radio’s disembodied voices; spirit photography and light therapies; psychic television; and magic on film.

184. SCIENCE AND RELIGION: A CRITICAL LOOK AT THEIR INTERACTION (3)

Olson, Cave (Chemistry). A seminar that examines a variety of interpretative strategies for approaching science/religion interactions; explores the historical patterns of interaction from the Bronze Age to the present; then concludes with an extended exploration of the place of science in the works of a major contemporary theologian such as Wolfhart Pannenberg.

SCIENCE, TECHNOLOGY AND SOCIETY**1. INTRODUCTION TO SCIENCE, TECHNOLOGY AND SOCIETY (3)**

de Laet. An introduction to the interactions among science, technology and society. Examines the different concepts of rationality and the values that underlie scientific and technological endeavors as well as the centrality of value conflict in technological controversies.

114. SOCIAL AND POLITICAL ISSUES IN TECHNICAL PROJECTS (3)

de Laet. A seminar offered to students taking Clinic. Preparation of a major paper analyzing the ethical and/or social issues of the student's Clinic project or the product or application for which the project is a part. Reading assignments on the interaction between society and technology and case studies of specific examples.

185. SCIENCE AND ENGINEERING FROM AN "OTHER" POINT OF VIEW (3)

Olson. Seeks to expand our understanding of the character and consequences of science and engineering by exploring how they have been and are viewed by representatives of groups, which have felt excluded or exploited, especially women, people of color, and underclass peoples of the "third world." Asks why relatively few women, members of some ethnic groups in the U.S., and members of Third World cultures participate in scientific and engineering professions, including questions about whether there are features of scientific and engineering institutions, conceptual structures, attitudes, and methodologies, which have encouraged and continued to encourage or amplify sexist, racist and imperialist behaviors.

SOCIAL SCIENCES**124. U.S. SCIENCE AND TECHNOLOGY POLICY (3)**

Olson. From the establishment of the United States to the present, issues involving the promotion, regulation or utilization of science and technology have constituted a significant concern of national policy makers. Course begins with an historical overview of the contexts for and character of federal involvement in science and technology, then turns to an analysis of a small number of student-selected current issues involving a major scientific and/or technological component, ranging from policies that regulate or promote scientific activities—such as stem cell research or research into alternative energy sources—through social policies such as health care policies, policies relating to global competitiveness, and national security policies. Environmental issues will be excluded unless they are focused on human health and safety issues because they are well covered in other courses in the curriculum.

147. ENTERPRISE AND THE ENTREPRENEUR (3)

Evans. Concepts and practices applicable to working as or with the manager of an enterprise. Some emphasis on enterprise formation and on management in high-technology firms.

150. PUBLIC SPEAKING FOR SCIENCE AND CITIZENSHIP (3)

Steinberg. This course builds student speaking skills in three areas: communicating advanced topics in science and technology to non-specialists; speaking out on questions of politics and values; and engaging the intersection of the two through presentations on technically intensive social controversies. (Fall)

180. TROPICAL FORESTS: POLICY AND PRACTICE (3)

Steinberg. This seminar takes stock of the past two decades of social science research on tropical forests, examining the scale of deforestation, its causes and consequences, and the track record of attempted solutions. Special emphasis is placed on the ways in which values, institutions and political-economic forces shape the decisions that will determine the fate of the forests.

SPECIAL TOPICS AND DIRECTED READING COURSES**179. SPECIAL TOPIC COURSES (3)**

Staff: Special topics courses—one-time or very occasional course offerings—are designated with the number 179. They may be offered in any discipline within the humanities and social sciences.

197–198. DIRECTED READING COURSES (1-3)

Staff: Students may arrange for directed readings with individual faculty members in the humanities and social sciences, subject to their permission, in order to pursue particular interests that are not covered by regular courses. Directed reading courses, designated with the number 197 (Fall) or 198 (Spring), may be taken in any discipline within the humanities and social sciences. The College limits such courses to juniors and seniors. See the discussion of “Directed Reading Courses” in the “Academic Regulations” section of this catalogue for other restrictions.

SPECIAL INTERDEPARTMENTAL AND INTERCOLLEGIATE PROGRAMS

The Department of Humanities, Social Sciences, and the Arts participates in a number of interdepartmental and intercollegiate programs that provide suitable areas for concentration and offer courses that may be of interest to HMC students:

AFRICANA STUDIES

The Intercollegiate Department of Africana Studies offers a multidisciplinary curriculum that examines the experiences of African, African American and Caribbean people from the liberal arts perspective. Courses accommodate the needs of majors and non-majors, providing significant preparation for careers in education, social work, public policy, law, medicine, business, international relations and advanced research. Consult Professors Isabel Balseiro or Talithia Williams (Mathematics).

AMERICAN STUDIES

American Studies is a multidisciplinary program that introduces students to the complexities of the American experience and encourages them to think critically about American culture. An essential component of the American Studies curriculum is Introduction to American Cultures, which is team-taught by members of the intercollegiate faculty. Consult Professors Hal Barron or Jeffrey Groves.

ASIAN-AMERICAN STUDIES

The Intercollegiate Asian American Studies Program offers an interdisciplinary approach to exploring the hitherto neglected experience of Asians in the U.S. The courses are open to all students of The Claremont Colleges, and they provide undergraduates with an understanding of the diversity and complexity of this segment of United States society. Consult Professors Hal Barron or Chang Tan.

CHICANO STUDIES

The Chicano Studies Intercollegiate Department, the academic program of the Chicano Studies Center, offers a curriculum with a multidisciplinary approach to the study, research, interpretation and investigation of the Chicano/Latino experience. The courses are open to all students of The Claremont Colleges. In recognition of the vital presence of Chicanos and other Latinos in the West, Southwest, and increasingly the entire nation, Chicano studies provides significant preparation for students pursuing careers in education, social work, public policy, law, medicine, business and scholarly research. Consult Professor Isabel Balseiro.

ENVIRONMENTAL STUDIES

The HMC Center for Environmental Studies coordinates courses and research in all departments of the College, and provides links to major ongoing programs of environmental studies at other Claremont Colleges. A strong advising program administered by the center helps students arrange programs that take advantage of courses in their majors as well as concentrations in the humanities and social sciences program, leading to a strong emphasis in environmental studies as a part of the Harvey Mudd College degree. Consult Professor Richard Haskell (Physics) and see www.environcenter.hmc.edu.

MEDIA STUDIES

Media Studies is an intercollegiate program offered in coordination with the other Claremont Colleges. Harvey Mudd students may concentrate in video production as a fine art or media studies as a discipline in the humanities, although students with particular interests in communication, digital media or other specialized fields may also pursue them through elective courses and by designing a special concentration. Consult Professors William Alves or Rachel Mayeri.

MUSIC

In addition to its own offerings in music, Harvey Mudd College participates in the Joint Music Program with Claremont McKenna, Pitzer and Scripps Colleges. Courses are offered in music history and theory, as well as private or class instruction in performance and chamber music at the Scripps College Music Department. Consult Professors William Alves, David Cubek or Charles Kamm.

POLITICAL STUDIES

Political Studies examine political values, interests, institutions, power and the processes of governing. Courses explore these questions using a variety of methodological approaches. Consult Professor Paul Steinberg.

RELIGIOUS STUDIES

The intercollegiate program in Religious Studies recognizes the importance and legitimacy of personal involvement in the study of religion, but it does not represent or advocate any particular religion as normative. Rather, its aim is to make possible an informed knowledge and awareness of the fundamental importance of the religious dimension in all human societies—globally and historically. Consult Professors Erika Dyson or Richard Olson.

SCIENCE, TECHNOLOGY AND SOCIETY (STS)

The STS program is designed to deepen students' understanding of both the context in which science and technology develop and the social consequences of scientific and technological change. Work in STS should not only enhance prospective scientists' and engineers' abilities to exercise influence within and on behalf of their professional communities, but also to assess the probable social impacts of their work. In addition, the program is intended to provide background for graduate work or career choices in such fields as history of science and technology, philosophy of science, public policy, law, medicine, science writing, science librarianship or secondary school science teaching. The college's interdepartmental Hixon Forum for Responsive Science and Engineering works directly and cooperatively with the Claremont STS program. Consult Professors Marianne de Laet or Richard Olson.

THEATER

Theater is one of the liberal arts and serves students from the five undergraduate colleges. It includes acting, design, directing, theater history and dramatic literature, and the practice of theater. Students concentrating in theater become proficient in bringing creative solutions to complex problems. They also develop sensitivity to the interpersonal relationships inherent in the collaborative process. Thus, they are prepared for a wide variety of careers in organizations and enterprises that value these qualities. The program is housed in excellent facilities at Pomona College. Consult Professor Jeffrey Groves.

WOMEN'S STUDIES

Women's Studies at HMC is part of an interdisciplinary and intercollegiate program that focuses on the nature and scope of women's achievement, promotes open and rigorous inquiry about women and sex roles, and questions cultural assumptions about women's place. This program also explores such areas as the relationship between gender and society historically and cross-culturally; the changing roles and concepts of women; and women's participation in major social institutions. Consult Professor Isabel Balseiro.

MATHEMATICS

(See also Joint Major in Computer Science and Mathematics, and Mathematical Biology)

Professors Bernoff (Chair), Benjamin, Borrelli (emeritus), Castro, Coleman (emeritus), Davis (2010–2012), de Pillis, Gu, Jacobsen, Karp, Krieger (emeritus), Levy, Martonosi, Orrison, Pippenger, Su, Tucker (2007–2011), Whitcher (2009–2011), Williams and Yong.

A mathematics degree from Harvey Mudd College will prepare students for a variety of careers in business, industry or academics. Mathematical methods are increasingly employed in fields as diverse as finance, biomedical research, management science, the computer industry and most technical and scientific disciplines. To support the academic and professional goals of our majors, we offer a wide selection of courses in both pure and applied mathematics. This selection is enhanced by courses offered in cooperation with the other Claremont Colleges, including graduate courses at the Claremont Graduate University.

Students will have many opportunities to do mathematical research with faculty through independent study, a summer research experience, or their senior capstone experience. Active areas of mathematical research at HMC and The Claremont Colleges include algebra, algebraic geometry, algorithms and computational complexity, combinatorics, differential geometry, dynamical systems, fluid mechanics, graph theory, number theory, numerical analysis, mathematical biology, mathematics education, operations research, partial differential equations, real and complex analysis, statistical methods and analysis, and topology.

The culmination of the degree is the senior capstone research experience: every student experiences a taste of the life of a professional mathematician as part of a team in the Mathematics Clinic Program or by working individually on a Senior Thesis.

An educational innovation of HMC, our Clinic Program brings together teams of students to work on a research problem sponsored by business, industry or government. Teams work closely with a faculty advisor and a liaison provided by the sponsoring organization to solve complex real-world problems using mathematical and computational methods. Clinic teams present their results in bound final reports to the sponsors and give several formal presentations on the progress of the work during the academic year.

Our Senior Thesis program provides students with the opportunity to work independently on a problem of their choosing. Advisors and readers may be chosen from the HMC faculty and the other mathematicians at The Claremont Colleges, providing students with a wealth of research opportunities. As with Clinic, the end product of a thesis is a bound volume as well as presentations made at a professional conference or other venue and during College-wide events, including Presentations Days.

The course of study for a mathematics degree has five components: The Major Core, Computational Mathematics, Clinic or Thesis, Mathematics Forum and Mathematics Colloquium and the Elective Program. Each of these components to the major program is described below.

THE MAJOR CORE

A set of core courses is required of each mathematics major. These courses cover a range of fundamental fields of mathematics and position the student to pursue any one of a variety of elective programs to finish the degree. The Major Core consists of Mathematics 55 (Discrete Mathematics), Mathematics 70 (Intermediate Linear Algebra), Mathematics 80 (Intermediate Differential Equations), Mathematics 131 (Mathematical Analysis I), Mathematics 157 (Intermediate Probability), Mathematics 171 (Abstract Algebra I) and Mathematics 180 (Applied Analysis).

COMPUTATIONAL MATHEMATICS

Computational techniques are essential to many fields of modern mathematics and to most mathematical applications in business and industry. One course in computational mathematics is required of all mathematics majors, selected from the following list: Mathematics 164 (Scientific Computing), Mathematics 165 (Numerical Analysis), Mathematics 167 (Complexity Theory), Mathematics 168 (Algorithms), Biology 188 (Computational Biology) or Computer Science 81 (Computability and Logic).

CLINIC OR THESIS

Two semesters of Mathematics Clinic (Mathematics 193) or two semesters of Senior Thesis (Mathematics 197) are required and normally taken in the senior year. Clinic and thesis are important capstone experiences for each mathematics major: they represent sustained efforts to solve a complex problem from industry or mathematical research. To do a senior thesis, students must prepare a senior research proposal with the help of their thesis advisor. The proposal will describe the intended senior research project and must be submitted to the Department of Mathematics for approval before the end of the junior year. Clinic teams will be formed in the fall according to the requirements of the projects and student preferences. Students who do Clinic must work on the same Clinic project both semesters.

MATHEMATICS FORUM AND MATHEMATICS COLLOQUIUM

All mathematics majors must take one semester of Mathematics Forum (Mathematics 198) and one semester of Mathematics Colloquium (Mathematics 199), generally in the junior year. In the mathematics forum, students prepare and present talks on mathematical topics taken from the literature. As a requirement for the mathematics forum, students must submit a tentative description of their proposed elective program to the department by the end of the fall semester of the junior year.

THE ELECTIVE PROGRAM

To complete the degree, three elective mathematics courses totaling at least seven credit hours are required. The elective program will be designed by the student in consultation with his or her advisor. To assist students in designing their elective program, the department has prepared a variety of sample programs. These sample programs list courses that support a wide range of career goals in academics, business or industry. About half of our graduates immediately join the workforce and about half enter graduate school. Several sample elective programs are listed below. In each of these samples, the first two courses are strongly recommended; at least one additional course is to be selected in order to complete the elective program. We emphasize that sample elective programs are advisory. Students may follow a sample program or design one of their own.

(CS = Computer Science, CMC = Claremont McKenna College, CGU = Claremont Graduate University, PO = Pomona College)

Pure Mathematics: 132, 172 and at least one elective from 104, 106, 123, 135, 136, 142, 143, 147, 173, 175, 185, CGU 331, CGU 332, CGU 334.

Applied Mathematics: 136, 181 and at least one elective from 118, 119, 120, 132, 164, 165, 173, 182, 185, 187, 189, CGU 362, CGU 368, CGU 382.

Probability and Statistics: 152, 156 and at least one elective from 106, 132, 158, 159, 173, 187, CGU 351, CGU 355.

Operations Research: 156, 187 and at least one elective from 104, 106, 132, 152, 158, 159, 165, 168, 188.

Actuarial or Financial Mathematics: 109, 156 and at least one elective from 152, 158, 159, 165, 187, CGU 355, Econometrics (CMC 125, 126; CGU 382, 383, 384; PO 167).

Theoretical Computer Science: CS 81, 168 and at least one elective from 104, 106, 107, 123, 165, 167, 172, 175, CS 151, CS 152, CS 156.

Scientific Computing: 164, 165 and at least one elective from 118, 119, 136, 168, 173, 181, 182, 185, CS 156, CGU 362, CGU 368, CGU 382.

ADVISING

The mathematics faculty works closely with each mathematics major to develop a coherent program of elective courses that meets the student's professional and academic goals. The department meets once each year to discuss and evaluate student programs and to discuss student progress.

FACILITIES

The Department of Mathematics and the College provide excellent computational facilities. The department's Scientific Computing Laboratory houses workstations supporting classroom activities and student and faculty research in numerical analysis, algorithms, parallel computing, and scientific computing, addressing diverse problems in mathematical modeling (such as problems in fluid mechanics and mathematical biology), operations research and statistical analysis. Additional resources include Beowulf-style distributed parallel-computing clusters and multiprocessor, large-memory, parallel compute servers. The department supports a wide variety of commercial and free/open-source mathematical software packages such as Mathematica, Maple, MATLAB, R, and SAGE.

OTHER MATHEMATICAL ACTIVITIES AT HMC AND IN CLAREMONT

There are many opportunities outside of course work to enjoy and participate in mathematics. Some of these activities are described below.

The William Lowell Putnam Examination. The Putnam Exam is a national collegiate mathematics competition. Over 2,500 students from more than 400 institutions take the exam. It is a very challenging, 12-question exam lasting six hours (three hours in the morning and three in the afternoon). The problems on the exam can be solved using elementary methods so that students can take the exam every year they are at college. About 50 HMC students take the exam each year, one of the highest participation rates in the country. The HMC Putnam team has done very well in the competition. The HMC team has placed in the top 10 teams five times in the last 10 years; usually, HMC is the highest ranked undergraduate institution in the nation. The Putnam Seminar (Mathematics 191) meets weekly and is open to all students. This is a one-unit course that will help to prepare students for the competition.

Michael E. Moody Lecture Series. The Moody evening lecture series brings speakers to the College who illuminate the joy, wonder and applications of mathematics, attracting hundreds of students and other members of the Claremont Colleges community.

Weekly Mathematics Colloquium. The Claremont Colleges Mathematics Colloquium meets once per week. Most of the colloquium speakers are mathematicians from around the country who speak about their research or give talks of general mathematical interest. To encourage undergraduates to attend, all speakers are encouraged to design their talk to be accessible to undergraduate mathematics majors.

Mathematics Seminars. Several weekly seminars on special mathematical topics are offered in Claremont each year. Recent seminars include combinatorics, analysis, applied mathematics, operations research, statistics, financial mathematics, population dynamics and topology. Faculty, CGU graduate students and advanced undergraduate students attend the seminars.

Mathematical/Interdisciplinary Contests in Modeling (MCM/ICM). The MCM/ICM contests are sponsored by the Consortium for Mathematics and its Applications and the Society for Industrial and Applied Mathematics. Each year, the MCM/ICM contests propose challenging open-ended problems in applied mathematics. Competing schools form teams of three students to work on the problems over a long weekend. Teams cannot consult with any person on their solution, but otherwise can use any resource available to them: computers, reference literature from the library or Internet resources. Each year, HMC has between two and eight teams competing in the MCM and ICM, out of over 2,500 teams internationally. HMC has earned the highest award of Outstanding more than any other institution in the competition.

Some Recent Clinic Projects

As described above, Clinic teams work together for two semesters to solve an open problem from business, industry or government. Listed below are a few examples of recent Clinic projects and the names of the sponsors.

- CareFusion. *Modeling Fluid Transport in Subcutaneous Tissue*
- Chicago Trading Company. *Building a Multi-Agent Artificial Stock Market*
- Laserfiche. *Automated Dewarping Algorithms for Enhancing Camera-Based Document Acquisition*
- Los Alamos National Laboratories. *Mathematical and Computational Modeling of Tumor Development*
- Overture Services, Inc. *Improved Relevance Ordering for Web Search*
- Sandia National Laboratories. *Improving GPS Algorithms*
- ViaSat, Inc. *Elliptic Curve Cryptography Scheme for Asymmetric Key Generation*

Some Recent Senior Theses

Several students write a senior thesis each year. It is common that theses result in papers that are submitted to mathematical journals for publication. Below are titles of several recent senior theses:

- A Fast Fourier Transform for the Symmetric Group
- Connections Between Voting Theory and Graph Theory
- Foraging Fruit Flies: Lagrangian and Eulerian Descriptions of Insect Swarming
- Improving Cataract Surgery Rates Through Incidence Estimation
- Kolmogorov Complexity of Graphs
- Mathematical AIDS Epidemic Model: Preferential Anti-Retroviral Therapy Distribution in Resource Constrained Countries
- The Negs and Regs of Continued Fractions
- Turing Pattern Dynamics for Spatio-Temporal Models with Growth and Curvature

MATHEMATICS COURSES

(Includes mathematics courses frequently taken by HMC students at the other Claremont Colleges)

15. APPLICATION AND ART OF CALCULUS (1)

Whitcher, Williams. This course is a fun and casual problem solving experience in single variable calculus. We will help the students strengthen mathematical skills essential to excel in the HMC Core. Students work in groups and solve calculus problems with an emphasis on applications to the sciences. Prerequisites: permission of department only. (Fall)

25B/25G. CALCULUS AND LINEAR ALGEBRA (3)

Benjamin, de Pillis, Karp, Levy, Orrison, Su. Theory and techniques of differential and integral calculus of a single real or complex variable; infinite series, including Taylor series and convergence tests. Theory and applications of vectors and matrices, including systems of linear equations; linear transformations in Euclidean space; determinants, eigenvalues, eigenvectors, and diagonalization. An introduction to multivariable calculus, including partial derivatives, double and triple integrals. The topics covered in 25B are the same as those covered in 25G, but 25B digs deeper into the theory and applications of the materials. Prerequisites: Mastery of single-variable calculus—entry into 25B by department placement only. (Fall)

35/62. PROBABILITY AND STATISTICS (1.5)

Benjamin, Martonosi, Orrison, Su, Williams. Sample spaces, events, axioms for probabilities; conditional probabilities and Bayes' theorem; random variables and their distributions, discrete and continuous; expected values, means and variances; covariance and correlation; law of large numbers and central limit theorem; point and interval estimation; hypothesis testing; simple linear regression; applications to analyzing real data sets. Prerequisites: Mathematics 12, 25B or 25G. (Mathematics 62 first half, Fall 2010; replaced by Mathematics 35 starting Spring 2011)

45. INTRODUCTION TO DIFFERENTIAL EQUATIONS (1.5)

Bernoff, Castro, de Pillis, Jacobsen, Levy, Su, Whitchee, Yong. Modeling physical systems, first-order ordinary differential equations, existence, uniqueness, and long-term behavior of solutions; bifurcations; approximate solutions; second-order ordinary differential equations and their properties, applications; first-order systems of ordinary differential equations. Prerequisites: Mathematics 25B or 25G. (Spring)

55. DISCRETE MATHEMATICS (3)

Benjamin, Bernoff, Orrison, Tucker. Topics include combinatorics (clever ways of counting things), number theory and graph theory with an emphasis on creative problem solving and learning to read and write rigorous proofs. Possible applications include probability, analysis of algorithms and cryptography. Prerequisites: Mathematics 12 or Mathematics 25B or 25G; or permission of the instructor. (Fall and Spring)

60. MULTIVARIABLE CALCULUS (1.5)

Bernoff, Castro, Gu, Karp, Levy, Orrison, Su, Yong. Review of basic multivariable calculus; optimization and the second derivative test; higher order derivatives and Taylor approximations; line integrals; vector fields, curl, and divergence; Green's theorem, divergence theorem and Stokes' theorem, outline of proof and applications. Prerequisites: Mathematics 25B or 25G. (Fall, 2011 on)

64A/65. DIFFERENTIAL EQUATIONS/LINEAR ALGEBRA II (1.5)

Bernoff, Castro, Jacobsen, Levy, Martonosi. General vector spaces and linear transformations; change of basis and similarity; generalized eigenvectors; Jordan canonical forms. Applications to linear systems of ordinary differential equations, matrix exponential; Nonlinear systems of differential equations; equilibrium points and their stability. Prerequisites: Mathematics 64A or Mathematics 12 and 13; Mathematics 46, 60; or permission from the instructor/department. (Mathematics 64A, second half Fall semester; replaced by Mathematics 65 starting Fall 2011)

70. INTERMEDIATE LINEAR ALGEBRA (1.5)

de Pillis, Gu, Orrison. This half course is a continuation of Mathematics 65 and is designed to increase the depth and breadth of students' knowledge of linear algebra. Topics include: Vector spaces, linear transformations, eigenvalues, eigenvectors, inner-product spaces, spectral theorems, Jordan Canonical Form, singular value decomposition, and others as time permits. Prerequisites: Mathematics 64A or 65; or the equivalent. (First half, Spring semester)

80. INTERMEDIATE DIFFERENTIAL EQUATIONS (1.5)

Bernoff, Castro, de Pillis, Jacobsen, Levy. This half course is a continuation of Mathematics 65 and is designed to increase the depth and breadth of students' knowledge of differential equations. Topics include: nonlinear systems (stability for autonomous systems, Lyapunov functions, periodic solutions, limit cycles, chaos), the Laplace Transform, power-series methods, and others as time permits. Prerequisites: Mathematics 64A or 65; or the equivalent. (Second half, Spring semester)

104. GRAPH THEORY (3)

Martonosi, Orrison, Pippenger. An introduction to graph theory with applications. Theory and applications of trees, matchings, graph coloring, planarity, graph algorithms, and other topics. Prerequisites: Mathematics 25B or 25G and Mathematics 55. (Offered alternate years)

106. COMBINATORICS (3)

Benjamin, Orrison, Pippenger. An introduction to the techniques and ideas of combinatorics, including counting methods, Stirling numbers, Catalan numbers, generating functions, Ramsey theory and partially ordered sets. Prerequisites: Mathematics 55; or permission of instructor. (Offered alternate years)

107. SET THEORY (3)

Bull (Pomona). Naive set theory, Zermelo-Fraenkel axioms and the axiom of choice; ordinal and cardinal arithmetic; construction of real numbers. Prerequisites: Mathematics 12 or Mathematics 25B or 25G. (Offered alternate years)

108. HISTORY OF MATHEMATICS (3)

Grabiner (Pitzer). A survey of the history of mathematics from antiquity to the present. Topics emphasized will include: the development of the idea of proof, the "analytic method" of algebra, the invention of the calculus, the psychology of mathematical discovery, and the interactions between mathematics and philosophy. Prerequisites: Mathematics 11 or Mathematics 25B or 25G. (Offered alternate years)

109. INTRODUCTION TO THE MATHEMATICS OF FINANCE (3)

Aksy (CMC). This course emphasizes the mathematics used in the valuation of derivative securities. Topics will include partial differential equations (diffusion equation), mathematical modeling of financial derivatives (calls and puts), and numerical methods for solving differential equations; Black-Scholes Model. Prerequisites: Mathematics 64A or 65 or (Mathematics 63 and 64) or permission of instructor. (Offered alternate years)

110. APPLIED MATHEMATICS FOR ENGINEERING (1.5) (Also cross-listed as Engineering 72)

Levy, Yong, Bassman (Engineering). Applications of differential equations, linear algebra, and probability to engineering problems in multiple disciplines. Mathematical modeling, dimensional analysis, scale, approximation, model validation. Prerequisites: Mathematics 62 and Mathematics 64A or 65; or the equivalent. (Spring)

115. FOURIER SERIES AND BOUNDARY VALUE PROBLEMS (3)

Bernoff, Levy, Yong. Complex variables and residue calculus; Laplace transforms; Fourier series and the Fourier transform; Partial Differential Equations including the heat equation, wave equation, and Laplace's equation; Separation of variables; Sturm-Liouville theory and orthogonal expansions; Bessel functions. (May not be included in a mathematics major program. Students may not receive credit for both Mathematics 115 and 180.) Prerequisites: Mathematics 64A or 65; or Mathematics 63 and 64; or the equivalent. (Spring)

118. MATHEMATICAL BIOLOGY I (2) (Also listed as Biology 118)

de Pillis, Jacobsen, Levy, Adolph (Biology), Nadim (CGU/KGI). Mathematical models of biological processes emphasizing continuous models. May include models in epidemiology, popula-

tion dynamics, cancer modeling, and disease treatment modeling. Prerequisites: Mathematics 64A or 65; or Mathematics 63 and 64; Biology 52; or permission of instructor. (First half of Spring semester)

119. MATHEMATICAL BIOLOGY II (2) (Also listed as Biology 119)

de Pillis, Jacobsen, Levy, Adolph (Biology), Nadim (CGU/KGI). Mathematical models of biological processes emphasizing discrete and continuous models. May include one- and two-locus population genetics, metapopulations, and matrix population models as well as models in physiology and neurobiology. Prerequisites: Mathematics 64A or 65; or Mathematics 63 and 64; Biology 52; or permission of instructor. (Second half, Spring semester)

120. CHIRALITY (2)

Flapan (Pomona). A structure is chiral if it is different from its mirror image. This interdisciplinary course introduces students to topological and geometric symmetry and provides descriptions of chirality in molecular systems. Connections will be made between the chemical and mathematical theories of chirality. Molecules with interesting topological features will be introduced and their structural behavior discussed. Prerequisites: Mathematics 12 or Mathematics 25B or 25G. (Offered alternate years in Spring semester)

123. LOGIC (3)

Bull (Pomona). Propositional and first order predicate logic. The completeness, compactness and Lowenheim/Skolem theorems. Decidable theories. Applications to other areas of mathematics, e.g., nonstandard analysis. Prerequisites: Mathematics 12 or Mathematics 25B or 25G. (Offered jointly at Pomona in alternate years)

131. MATHEMATICAL ANALYSIS I (3)

Castro, Karp, Su. Countable sets, least upper bound, and metric space topology including compactness, completeness, connectivity, and uniform convergence. Related topics as time permits. Prerequisites: (Mathematics 12 and Mathematics 14) or (Mathematics 25B or 25G) and Mathematics 60). (Offered jointly; Fall semester at Pomona, Spring semester at HMC and CMC)

132. MATHEMATICAL ANALYSIS II (3)

Castro, Su, Radunskaya (Pomona). A rigorous study of calculus in Euclidean spaces including multiple Riemann integrals, derivatives of transformations and the inverse function theorem. Prerequisites: Mathematics 131. (Offered jointly; Fall semester at HMC, Spring semester at Pomona)

136. COMPLEX VARIABLES AND INTEGRAL TRANSFORMS (3)

Gu, Jacobsen, Karp, Yong. Complex differentiation, Cauchy-Riemann equations, Cauchy integral formulas, residue theory, Taylor and Laurent expansions, conformal mapping, Fourier and Laplace transforms, inversion formulas, other integral transforms, applications to solutions of partial differential equations. Prerequisites: Mathematics 64A or 65; or Mathematics 63 and 64. (Fall)

137. GRADUATE ANALYSIS I (3) (Also listed as Mathematics 331 CG)

Castro, Krieger, Grabiner (Pomona), O'Neill (CMC). Abstract Measures, Lebesgue measure, and Lebesgue-Stieltjes measures on \mathbb{R} ; Lebesgue integral and limit theorems; product measures and the Fubini theorem; additional topics. Prerequisites: Mathematics 132. (Fall)

138. GRADUATE ANALYSIS II (3) (Also listed as Mathematics 332 CG)

Castro, Krieger, Grabiner (Pomona), O'Neill (CMC). Banach and Hilbert spaces; L^p spaces; complex measures and the Radon-Nikodym theorem. Prerequisites: Mathematics 137 or 331 CG. (Spring)

142. DIFFERENTIAL GEOMETRY (3)

Gu, Karp, Bachman (Pitzer). Curves and surfaces, Gauss curvature; isometries, tensor analysis,

covariant differentiation with application to physics and geometry (intended for majors in physics or mathematics). Prerequisites: Mathematics 64A or 65; or Mathematics 63 and 64. (Fall)

IE 142. SEMINAR ON MATHEMATICS AND SCIENCE EDUCATION (INTEGRATIVE EXPERIENCE) (3)

Levy, Yong, Dodds (Computer Science). Students will learn about and contribute to mathematics and science education in our community. Over the course of the semester, students observe mathematics and science classrooms and reach out to integrate with our readings and discussions, which will be centered around questions such as, “What is effective mathematics and science teaching?”, “What is effective mathematics and science education?”, and, “How does mathematics and science education impact our society?” Prerequisites: none. (Fall or Spring)

143. SEMINAR IN DIFFERENTIAL GEOMETRY (3)

Gu. Selected topics in Riemannian geometry, low dimensional manifold theory, elementary Lie groups and Lie algebra, and contemporary applications in mathematics and physics. Prerequisites: Mathematics 131 or Mathematics 132 or 142; *recommended* Mathematics 147; or permission of instructor. (Spring)

IE 144. MATHEMATICS, MUSIC, ART: COSMIC HARMONY (INTEGRATIVE EXPERIENCE) (3)

Orrison, Alves (Humanities, Social Sciences, and the Arts). A seminar exploring some of the many intersections between mathematics and music within our own and non-Western cultures, including proportion in art, tuning systems, algorithmic composition, artificial intelligence and creativity, and music synthesis. The class will also examine the ethical, aesthetic, and cultural ramifications of compression technology, sampling, downloading, and the effects of technology on music and vice-versa. Prerequisites: none. (Fall or Spring)

147. TOPOLOGY (3)

Pippenger, Su, Flapan (Pomona). Topology is the study of properties of objects preserved by continuous deformations (much like geometry is the study of properties preserved by rigid motions). Hence, topology is sometimes called “rubber-sheet” geometry. This course is an introduction to point-set topology with additional topics chosen from geometric and algebraic topology. It will cover topological spaces, metric spaces, product spaces, quotient spaces, Hausdorff spaces, compactness, connectedness and path connectedness. Additional topics will be chosen from metrization theorems, fundamental groups, homotopy of maps, covering spaces, the Jordan curve theorem, classification of surfaces and simplicial homology. Prerequisites: Mathematics 131; or permission of instructor. (Offered jointly with Pomona; Spring)

148. KNOT THEORY (3)

Hoste (Pitzer). An introduction to theory of knots and links from combinatorial, algebraic, and geometric perspectives. Topics will include knot diagrams, p -colorings, Alexander, Jones, and HOMFLY polynomials, Seifert surfaces, genus, Seifert matrices, the fundamental group, representations of knot groups, covering spaces, surgery on knots, and important families of knots. Prerequisites: Mathematics 147 or 171; or permission of instructor. (Offered alternate years)

152. STATISTICAL THEORY (3)

Martonosi, Williams, Hardin (Pomona), Huber (CMC). An introduction to the general theory of statistical inference, including estimation of parameters, confidence intervals and tests of hypotheses. Prerequisites: Mathematics 151 or 157; or permission of instructor. (Offered jointly; Spring at Pomona and CMC)

156. STOCHASTIC PROCESSES (3)

Benjamin, Krieger, Martonosi, Huber (CMC). Continuation of Mathematics 157. This course is particularly well suited for those wanting to see how probability theory can be applied to the study of phenomena in fields such as engineering, management science, the physical

and social sciences, and operations research. Topics include conditional expectation, Markov chains, Poisson processes, and queuing theory. Additional applications chosen from such topics as reliability theory, Brownian motion, finance and asset pricing, inventory theory, dynamic programming, and simulation. Prerequisites: Mathematics 64A or 65; or Mathematics 63 and 64; and Mathematics 151 or 157; or permission of instructor. (Offered jointly; Fall at HMC)

157. INTERMEDIATE PROBABILITY (2)

Benjamin, Martonosi, Pippenger, Su, Williams. Continuous random variables, distribution functions, joint density functions, marginal and conditional distributions, functions of random variables, conditional expectation, covariance and correlation, moment generating functions, law of large numbers, Chebyshev's theorem and central-limit theorem. (Formerly Mathematics 151.) Prerequisites: Mathematics 62 or 35; or permission of instructor. (Offered first half of Spring)

158. STATISTICAL DATA ANALYSIS (3)

Martonosi, Williams, Hardin (Pomona). An introduction to analysis of variance (including one-way and two-way fixed effects ANOVA) and linear regression (including simple linear regression, multiple regression, variable selection, stepwise regression and analysis of residual plots). Emphasis will be both on methods and on applications to data using statistical software. Prerequisites: Mathematics 62 or 35; or AP Statistics or permission of instructor. (Offered second half of Spring, alternate years)

159. DESIGN AND ANALYSIS OF EXPERIMENTS (2)

Martonosi, Williams. Prior to conducting an experiment, a scientist or engineer must properly structure the trials in order to draw meaningful conclusions from the data s/he collects. This course addresses, from a statistical perspective, how experiments should be designed so that the effects of the factors being tested can be distinguished from one another and from the variability inherent in the system. We will consider several design types, from practical and mathematical standpoints, such as Randomized Blocks, Latin Squares, Two-Level Factorial and Fractional Factorial designs, Response Surface Methods, Random Factors, and Robust Design. Students will use statistical software to analyze real data and complete a term project. Prerequisites: Mathematics 62 or 35; or the equivalent. (Offered in alternate years, second-half Spring semester)

164. SCIENTIFIC COMPUTING (3)

Bernoff, de Pillis, Levy, Yong. Computational techniques applied to problems in the sciences and engineering. Modeling of physical problems, computer implementation, analysis of results; use of mathematical software; numerical methods chosen from: solutions of linear and nonlinear algebraic equations, solutions of ordinary and partial differential equations, finite elements, linear programming, optimization algorithms and fast-Fourier transforms. Prerequisites: Mathematics 64A or 65; or Mathematics 63 and 64; and Computer Science 60 or permission of instructor. (Spring)

165. NUMERICAL ANALYSIS (3)

Bernoff, Castro, de Pillis, Levy, Pippenger, Yong. An introduction to the analysis and computer implementation of basic numerical techniques. Solution of linear equations, eigenvalue problems, local and global methods for non-linear equations, interpolation and approximate integration. Prerequisites: Mathematics 64A or 65; or Mathematics 63 and 64; or permission of instructor. (Fall)

167. COMPLEXITY THEORY (3) (Also listed as Computer Science 142)

Pippenger, Libeskind-Hadas (Computer Science), Bull (Pomona). Specific topics include finite automata, pushdown automata, Turing machines, and their corresponding languages and grammars; undecidability; complexity classes, reductions, and hierarchies. Prerequisites: Computer Science 60 and Mathematics 55. (Fall)

168. ALGORITHMS (3) (Also listed as Computer Science 140)

Pippenger, Libeskind-Hadas (Computer Science), Sweedyk (Computer Science). Algorithm design, computer implementation, and analysis of efficiency. Discrete structures, sorting and searching, time and space complexity, and topics selected from algorithms for arithmetic circuits, sorting networks, parallel algorithms, computational geometry, parsing, and pattern-matching. Prerequisites: Mathematics 55 and Computer Science 60 and Mathematics 131. (Fall and Spring)

171. ABSTRACT ALGEBRA I (3)

Benjamin, Davis, Karp, Orrison, Sarkis (Pomona), Shahriari (Pomona). Groups and isomorphism theorems. Rings and other structures. Prerequisites: (Mathematics 12 or 25B or Mathematics 25G) and Mathematics 55; or permission of instructor. (Offered jointly; Fall semester at HMC and CMC, Spring semester at Pomona)

172. ABSTRACT ALGEBRA II: GALOIS THEORY (3)

Davis, Karp, Orrison, Su, Sarkis (Pomona), Shahriari (Pomona). The topics covered will include polynomial rings, field extensions, classical constructions, splitting fields, algebraic closure, separability, Fundamental Theorem of Galois Theory, Galois groups of polynomials and solvability. Prerequisites: Mathematics 171. (Offered jointly; Spring semester at HMC and Pomona)

173. ADVANCED LINEAR ALGEBRA (3)

de Pillis, Gu, Orrison. Topics from among the following: Similarity of matrices and the Jordan form, the Cayley-Hamilton theorem, limits of sequences and series of matrices; the Perron-Frobenius theory of nonnegative matrices, estimating eigenvalues of matrices; stability of systems of linear differential equations and Lyapunov's Theorem; iterative solutions of large systems of linear algebraic equations. Prerequisites: Mathematics 131; or the equivalent. (Offered jointly in alternate years)

174. ABSTRACT ALGEBRA II: REPRESENTATION THEORY (3)

Davis, Karp, Orrison, Su. The topics covered will include group rings, characters, orthogonality relations, induced representations, applications of representation theory, and other select topics from module theory. Prerequisites: none. (Offered jointly; Spring semester at HMC and Pomona)

175. NUMBER THEORY (3)

Benjamin, Pippenger, Touse (Scripps). Properties of integers, congruences, Diophantine problems, quadratic reciprocity, number theoretic functions, primes. Prerequisites: Mathematics 55; or permission of instructor. (Spring; offered jointly Fall semester at Scripps)

180. APPLIED ANALYSIS (3)

Bernoff, Castro, de Pillis, Jacobsen, Levy. Partial Differential Equations (PDEs) including the heat equation, wave equation, and Laplace's equation; existence and uniqueness of solutions to PDEs via the maximum principle and energy methods; method of characteristics; Fourier series; Fourier transforms and Green's functions; separation of variables; Sturm-Liouville theory and orthogonal expansions; Bessel functions. Prerequisites: Mathematics 64A or 65; or Mathematics 63 and 64; and Mathematics 131; or permission of instructor. (Fall)

181. DYNAMICAL SYSTEMS (3)

Bernoff, de Pillis, Jacobsen, Levy, Radunskaya (Pomona). Existence and uniqueness theorems for systems of differential equations, dependence on data, linear systems, fundamental matrices, asymptotic behavior of solutions, stability theory, and other selected topics, as time permits. Prerequisites: Mathematics 115 or Mathematics 180. (Offered jointly; Fall semester at Pomona, Spring semester at HMC in alternate years)

182. PARTIAL DIFFERENTIAL EQUATIONS (3)

Bernoff, Castro, Jacobsen. Theory and applications of quasi-linear and linear equations of first order, including systems. Theory of higher order linear equations, including classical methods of solutions for the wave, heat, and potential equations. Prerequisites: Mathematics 115 or 180. (Spring; alternate years)

185. INTRODUCTION TO WAVELETS AND THEIR APPLICATIONS (2)

Staff. An introduction to the mathematical theory of wavelets, with applications to signal processing, data compression and other areas of science and engineering. Prerequisites: Mathematics 115 or 180; or permission of instructor.

187. OPERATIONS RESEARCH (3)

Benjamin, Martonosi, Huber (CMC), Shahriari (Pomona). Linear, integer, non-linear and dynamic programming, classical optimization problems, and network theory. Prerequisites: Mathematics 12 or 25B or 25G. (Offered jointly; Fall semester at HMC/CMC, alternate years)

188. SOCIAL CHOICE AND DECISION MAKING (3) (Also listed as Integrative Experience 198)

Su. Basic concepts of game theory and social choice theory, representations of games, Nash equilibria, utility theory, non-cooperative games, cooperative games, voting games, paradoxes, Arrow's impossibility theorem, Shapley value, power indices, "fair division" problems, and applications. Prerequisites: Mathematics 63 or 65; recommended Mathematics 55; or permission of instructor. (Offered alternate years, Spring)

189. SPECIAL TOPICS IN MATHEMATICS (1-3)

Staff. A course devoted to exploring topics of current interest to faculty or students. Recent topics have included: Algebraic Geometry, Algebraic Topology, Complex Dynamics, Fluid Dynamics, Games and Gambling, Mathematical Toys, and Riemann Zeta Functions. Prerequisites: permission of instructor.

190. MATHEMATICAL CONTEST IN MODELING/INTERDISCIPLINARY CONTEST IN MODELING SEMINAR (1)

Martonosi. This seminar meets one evening per week during which students solve and present solutions to challenging mathematical problems in preparation for the Mathematical Contest in Modeling (MCM) and Interdisciplinary Contest in Modeling (ICM), an international undergraduate mathematics competition. Prerequisites: none. (Fall)

191. PUTNAM SEMINAR (1)

Bernoff, Pippenger, Su. This seminar meets one evening per week during which students solve and present solutions to challenging mathematical problems in preparation for the Putnam Examination, a national undergraduate mathematics competition. Prerequisites: none. (Fall)

192. PROBLEM SOLVING SEMINAR (1)

Bernoff. This seminar meets one evening per week during which students solve and present solutions to problems posed in mathematics journals, such as the American Mathematical Monthly. Solutions are submitted to these journals for potential publication. Prerequisites: none. (Spring)

193. MATHEMATICS CLINIC (3)

Bernoff, Castro, de Pillis, Gu, Levy, Martonosi, Williams. The Clinic Program brings together teams of students to work on a research problem sponsored by business, industry or government. Teams work closely with a faculty advisor and a liaison provided by the sponsoring organization to solve complex real-world problems using mathematical and computational methods. Students are expected to present their work orally and to produce a final report conforming to the publication standards of a professional mathematician. (Fall and Spring)

196. INDEPENDENT STUDY (1-5)

Staff. Readings in special topics. Prerequisites: permission of department. (Fall and Spring)

197. SENIOR THESIS (3)

Staff. Senior thesis offers the student, guided by the faculty advisor, a chance to experience a taste of the life of a professional research mathematician. The work is largely independent with guidance from the research advisor. The principal objective of the senior thesis program is to help you develop intellectually and improve your written and verbal communication skills. Students are expected to present their work orally and to produce a thesis conforming to the publication standards of a professional mathematician. Prerequisites: permission of department. (Fall and Spring)

198. UNDERGRADUATE MATHEMATICS FORUM (1)

Castro, Jacobsen, Levy, Orrison, Yong. The goal of this course is to improve students' ability to communicate mathematics, both to a general and technical audience. Students will present material on assigned topics and have their presentations evaluated by students and faculty. This format simultaneously exposes students to a broad range of topics from modern and classical mathematics. Prerequisites: Required for all majors; recommended for all joint computer science-mathematics majors and mathematical biology majors, typically in the junior year. (Fall and Spring)

199. MATHEMATICS COLLOQUIUM (0.5)

Benjamin, Jacobsen. Students will attend weekly Claremont Mathematics Colloquium, offered through the cooperative efforts of the mathematics faculty at The Claremont Colleges. Most of the talks discuss current research in mathematical sciences, and are accessible to undergraduates. No more than 2.0 units of credit can be earned for colloquia. Pass/No Credit grading. Prerequisites: none. (Fall and Spring)

In addition to the courses described above, the graduate program in mathematics at the Claremont Graduate University offers a variety of courses. Graduate courses most often taken by advanced students at HMC include:

331. MEASURE AND INTEGRATION

334. ADVANCED COMPLEX ANALYSIS

362. NUMERICAL METHODS FOR PDEs

332. FUNCTIONAL ANALYSIS

351. TIME SERIES ANALYSIS

382. PERTURBATION AND ASYMPTOTICS

PHYSICAL EDUCATION

Professors Sutton (Chair), Burton, Calichman, Candaele, Goldhammer, Graves, Griffiths, Hipple, Lonzo, Miles, M. Retzlaff, S. Retzlaff, Sanchez, Scalmanini, Settles, Town.

COURSES

HMC students must complete three semester-long Physical Education (PE) courses to graduate. One of these three is a required physical fitness course for which students register in their first year; the other two are electives. Starting with fall 2010, one unit credit is given for these courses, with a maximum of 3.0 PE credits earned while a student at HMC. Students must register for these courses through the Harvey Mudd College Registrar's Office.

PHYSICAL FITNESS COURSE

Information about physical fitness; testing of physical strengths and weaknesses; aerobic training; development of the skills for a lifelong physical fitness program; introduction of students to the Claremont-Mudd-Scripps (CMS) PE/Athletic program, faculty, and facilities. The Harvey Mudd College Registrar distributes a list of approved fitness courses to first-year students each semester. These approved Joint PE (JP) fitness courses are taught by CMS PE Department full-time faculty. Season-long participation in an intercollegiate or club sports team approved by the CMS Athletic Department counts for the physical fitness course requirement, but the season-long participation should occur in the student's first year.

ELECTIVE COURSES

Semester-long courses in activities such as tennis, badminton, golf, bicycling, self defense, aerobics, running programs, and weight training with free weights and machines. Fitness training with an associated ROTC program or completion of a physical education course at Pomona College also fulfills a PE elective requirement. One season-long participation in an approved intercollegiate or club sports team may count for the two required elective courses.

PHYSICS

Professors Townsend (Chair), Chen, Donnelly, Eckert, Edwards, Esin, Haskell, Lynn, Lyzenga, Saeta, Sahakian and Sparks.

The physics program at Harvey Mudd College provides depth and breadth in both classical and modern physics through lecture-discussion courses, laboratories and joint student-faculty research. The program is designed to serve as a strong foundation for graduate work or employment in physics and other technical fields.

A set of core courses is required of all physics majors; in addition, a variety of elective courses enables students to select a program to suit their interests and their educational and employment objectives. Laboratory courses in both introductory and advanced physics include experience with electronics, classical and modern optics, solid-state physics, and atomic and nuclear physics. Special courses and reading courses provide the opportunity for study in advanced areas normally offered only in graduate programs.

Each student is encouraged to do individual experimental or theoretical research in an area of his/her special interest, in conjunction with a faculty member. Current student-faculty research areas include observational astronomy, astrophysics, biophysics, computational physics, field theory, general relativity and cosmology, geophysics, laser and atomic spectroscopy, magnetism, particle physics, quantum optics, quantum theory and solid-state physics. In some of the optional programs, physics majors may elect to do research in biology or chemistry or participate in Computer Science, Engineering, Mathematics or Physics Clinic team projects.

A physics major must satisfactorily complete the following courses: Physics 52, 54, 111, 116, 133, 134, 151, 195 (taken twice), 196 (taken twice), Mathematics 115 or 180. In addition, a physics major must satisfactorily complete the courses in one of the sets listed below. The first set constitutes the standard program in physics, but majors with a particular interest in one of the physics-related fields may substitute that set of courses for the standard program. A final oral and written report of completed research, Clinic or independent project work is required for all physics majors. The Physics 195/196 Colloquium requirement is waived for any semester during which a student is away on a study abroad program.

STANDARD PROGRAM

Two half-courses; Physics 117, 181; and at least 3 units of Physics 191–192.

OPTIONAL PROGRAMS

Applied Physics: Physics 117; two physics half-courses; Physics 181; and 3 units of Physics 191-192 or an approved Clinic.

Astrophysics: Astronomy 62; Physics 117; Physics 181 or Astronomy 101; two astronomy or physics half-courses; and at least 3 units of Physics 191–192.

Biophysics: Physics 174; Physics 181 or an approved biology laboratory; three of the following—two approved biology courses, Physics 117, Chemistry 56; and at least 3 units of Physics 191-192 or Biology 161-162.

Chemical Physics: Chemistry 51; Physics 117; Physics 161; Chemistry 168; Physics 181 or an approved chemistry laboratory; and at least 3 units of Physics 191–192 or Chemistry 151–152.

Education: Education 170G at Claremont Graduate University, to be taken in the junior year or earlier; 3 units of Physics 183–184; and 9 units of approved technical electives to add breadth. Recommended courses include Astronomy 62; Physics 166; Physics 170 or Computer Science 60; Biology 108; and Chemistry 51 or 103.

Geophysics: Physics 154 or 117; 166; 181; and at least 3 units of Physics 191–192 and one approved geology course.

Mathematical Physics: One physics half-course; Physics 117 or Physics 154, two additional courses, to be chosen from Physics 117, Physics 154, and mathematics courses numbered 100 or higher that are not included in the physics major requirements; and at least 3 units of Physics 191–192 or Mathematics 197 or an approved Clinic. Note: Physics 170 can be substituted for Physics 133 in this option provided Physics 170 is not used to meet the physics half-course requirement.

Physics and Computers: Physics 117 or two physics half-courses; Physics 170; Computer Science 60; at least 3 units of Physics 191–192 or an approved Clinic; two electives chosen from Mathematics 165, Engineering 155, or any computer science course numbered 70 or higher. Students planning a career or graduate studies in computer applications to problems in physics or engineering would particularly benefit from Physics 117 and Mathematics 165. Students planning graduate studies in computer science should take Computer Science 105 and additional computer science courses as time permits.

Changes in any of the above programs may be made by petition to the Department of Physics.

Most physics majors go on to graduate work in physics; in allied fields such as astronomy, biophysics, geophysics, oceanography and optics; or in applied areas such as computer science, electronics or engineering. Others undertake advanced study in medicine or law, or seek immediate employment in a variety of technical fields. Students who intend to go on to graduate study are advised to include Physics 154 and either Physics 161 or 168 in their program.

PHYSICS COURSES

22. PHYSICS LABORATORY (1)

Lynn, staff. This course emphasizes the evidence-based approach to understanding the physical world; students design, conduct, and interpret experiments to give quantitative answers to physical questions. Topics are drawn from a broad range of physics subjects, with applications to other technical fields. (Fall and Spring)

23. SPECIAL RELATIVITY (1.5)

Townsend, Staff. Time dilation, length contraction, Lorentz transformations, spacetime, relativistic momentum and energy; conservation laws. (Fall)

24. MECHANICS AND WAVE MOTION (3)

Staff. Kinematics, dynamics, linear and angular momentum, work and energy, harmonic motion, waves and sound. (Spring)

51. ELECTROMAGNETIC THEORY AND OPTICS (3)

Donnelly, Esin, Sahakian, staff. An introduction to electricity and magnetism leading to Maxwell's electromagnetic equations in differential and integral form. Selected topics in classical and quantum optics. Prerequisites: Physics 23–24 and Mathematics 60, or concurrently. (Fall)

52. QUANTUM PHYSICS (3)

Staff. The development and formulation of quantum mechanics, and the application of quantum mechanics to topics in atomic, solid state, nuclear and particle physics. Prerequisites: Physics 51; Mathematics 65 or concurrently. (Spring)

53. ELECTRICITY AND OPTICS LABORATORY (1)

Saeta, staff. Electrical and magnetic techniques in such measurements as an absolute determination of electric current and the earth's magnetic field; RC and RLC circuits; experiments

in physical optics, including image formation, Fraunhofer diffraction and spectroscopy. Prerequisite: Physics 51 or concurrently. (Fall)

54. MODERN PHYSICS LABORATORY (1)

Staff. Classical experiments of modern physics, including thermal radiation and Rutherford scattering. Nuclear physics experiments, including alpha, beta and gamma absorption, and gamma spectra by pulse height analysis. Analysis of the buildup and decay of radioactive nuclei. Prerequisites: Physics 53, Physics 52 or concurrently. (Spring)

80. TOPICS IN PHYSICS (3)

Saeta, staff. An area of physics is studied, together with its applications and social impact. Possible areas include energy and the environment, and global warming and climate change. Active participation and group activities are stressed. Prerequisite: Physics 51. (Spring)

111. THEORETICAL MECHANICS (3)

Saeta. The application of mathematical methods to the study of particles and of systems of particles; Newton, Lagrange and Hamilton equations of motion; conservation theorems; central force motion, collisions, damped oscillators, rigid body dynamics, systems with constraints, variational methods. Prerequisites: Physics 23-24 and Mathematics 25 and 45, or concurrently. (Fall)

116. QUANTUM MECHANICS (3)

Townsend. The elements of nonrelativistic quantum mechanics. Topics include the general formalism, one-dimensional and three-dimensional problems, angular momentum states, perturbation theory and identical particles. Applications to atomic and nuclear systems. Prerequisites: Physics 52. (Spring)

117. STATISTICAL MECHANICS AND THERMODYNAMICS (3)

Lyzenga. Classical and quantum statistical mechanics, including their connection with thermodynamics. Kinetic theory of gases. Applications of these concepts to various physical systems. Prerequisites: Physics 52 and Mathematics 35. (Fall)

133. ELECTRONICS LABORATORY (1)

Chen, Lyzenga. An intermediate laboratory in electronics involving the construction and analysis of rectifiers, filters, transistor and operational amplifier circuits. Prerequisite: Physics 53. (Fall)

134. OPTICS LABORATORY (2)

Staff. A laboratory-lecture course on the techniques and theory of classical and modern optics. Topics of study include diffraction, interferometry, Fourier transform spectroscopy, grating spectroscopy, lasers, coherence of waves and least-squares fitting of data. Prerequisites: Physics 51, 53. (Spring)

151. ELECTROMAGNETIC FIELDS (3)

Edwards. The theory of static and dynamic electromagnetic fields. Topics include multipole fields, Laplace's equation, the propagation of electromagnetic waves, radiation phenomena and the interaction of the electromagnetic field with matter. Prerequisites: Physics 111 or 116 and Mathematics 115. (Fall)

154. FIELDS AND WAVES (3)

Lyzenga. The theory of deformable media. Field equations for elastic and fluid media and for conducting fluids in electromagnetic fields. Particular emphasis on body and surface wave solutions of the field equations. Prerequisite: Mathematics 115. (Spring)

161. TOPICS IN QUANTUM THEORY (2)

Lynn. Scattering, including the Born approximation and partial wave expansion. Path integrals. Time-dependent perturbation theory. Quantum theory of the electromagnetic field. Prerequisite: Physics 116. (Fall)

162. SOLID STATE PHYSICS (2)

Chen. Selected topics in solid-state physics, including lattice structure, lattice excitations, and the motion and excitations of electrons in metals. Prerequisite: Physics 117 or equivalent. (First half of Spring)

164. PARTICLE PHYSICS (2)

Edwards. Topics in high-energy physics including the fundamental interactions, space-time symmetries, isospin, SU(3) and the quark model and the standard model. Prerequisite: Physics 116. (First half of Spring)

166. GEOPHYSICS (2)

Lyzenga. Special topics in geophysical methods and their application to construction of earth models. Prerequisite: Physics 23–24.

168. ELECTRODYNAMICS (2)

Staff. Selected topics in electrodynamics including wave propagation in material media. Prerequisite: Physics 151. (First half of Spring.)

170. COMPUTATIONAL METHODS IN PHYSICS (2)

Staff. Typical numerical methods for solving a wide range of problems of current interest in physics. Examples are drawn from mechanics, electromagnetism, quantum mechanics, statistical mechanics, solid state and chemical physics. Prerequisites: Physics 52 and the ability to program. (Spring)

172. GENERAL RELATIVITY AND COSMOLOGY (2)

Sabakian. The principle of equivalence, Riemannian geometry, and the Schwarzschild and cosmological solutions of the field equations. Prerequisite: Physics 111 or permission of instructor. (Second half of Spring)

174. BIOPHYSICS (2) (Also cross-listed as Biology 174)

Haskell. Selected topics in biophysics reflecting active research in the field. Possible topics: imaging techniques, membrane biophysics, sensory transduction, motility. Seminar format. Prerequisite: Biology 52, Physics 51. (Second half of Spring)

178. SPECIAL TOPICS IN PHYSICS (1–2)

Staff. The study of an area in physics not covered in other courses, chosen each year at the discretion of the Department of Physics. Prerequisites: Depend upon the topic offered.

181. ADVANCED LABORATORY (2)

Haskell. Experiments are selected from the fields of nuclear and solid-state physics, utilizing multichannel and time coincidence nuclear instrumentation and x-ray, optical spectrophotometer and thermoluminescent observations of the properties of solids. Prerequisite: Physics 134. (Fall)

183, 184. TEACHING INTERNSHIP (3)

Staff. An Introduction to K–12 classroom teaching and curriculum development. Internship includes supervision by an appropriate K–12 teacher and a member of the physics department and should result in a report of a laboratory experiment, teaching module, or other education innovation or investigation. Internship includes a minimum of three hours per week of classroom participation. Prerequisite: Education 170G at Claremont Graduate University, or corequisite by permission of instructor. (Fall and Spring)

191, 192. RESEARCH (1–3)

Staff. Original experimental or theoretical investigations in physics undertaken in consultation with a faculty member. Projects may be initiated by the student or by a faculty member. Present faculty research areas include astronomy, atomic and nuclear physics, optics, solid-state and low-temperature physics, general relativity, quantum mechanics, particle physics, geophysics and biophysics. (Fall and Spring)

193, 194. PHYSICS CLINIC (3)

Haskell. Team projects in applied physics, with corporate affiliation. Prerequisite: Upper-division standing. (Fall and Spring)

195, 196. PHYSICS COLLOQUIUM (0.5)

Staff. Oral presentations and discussions of selected topics, including recent developments. Participants include physics majors, faculty members and visiting speakers. Required for all junior and senior physics majors. No more than 2.0 units of credit can be earned for colloquium. Pass/No Credit grading. (Fall and Spring)

197, 198. READINGS IN PHYSICS (1–3)

Staff. Directed reading in selected topics. Open to seniors only. 1–3 credit hours per semester. (Fall and Spring)

ASTRONOMY**62. INTRODUCTION TO ASTROPHYSICS (3)**

Esin. A general survey of modern astrophysics. Topics covered include electromagnetic radiation, gravitation, stellar structure and evolution, the interstellar medium and the birth of stars, supernovae and the death of stars (including the physics of neutron stars and black holes), synthesis of the elements, and the formation, structure and evolution of galaxies and of the universe. Offered jointly with Pomona and Joint Sciences. Prerequisite: Physics 51 or equivalent. (Spring)

101. OBSERVATIONAL ASTRONOMY (3)

Staff. Complete survey of the techniques of observational astronomy, including optical, infrared, radio and X-ray astronomy. Four to six observational projects, including observations using The Claremont Colleges Table Mountain Observatory, plus computer projects analyzing radio and infrared data. Observational techniques used include CCD photometry, stellar spectroscopy, radio interferometry and analysis of infrared satellite data. In addition to observational techniques, the course will also cover the physics of basic emission mechanisms at the various wavelengths. Offered jointly with Pomona and Joint Sciences. Prerequisite: Astronomy 62 or permission of the instructor. (Fall)

120. STAR FORMATION AND THE INTERSTELLAR MEDIUM (2)

Staff. A survey of formation of stars and planets in the universe, the galactic interstellar medium, and the theoretical and observational aspects of understanding the physical state of matter in the galaxy. Topics include formation and detection of extrasolar planets and protostars, radio and infrared diagnostics of star forming regions and interstellar clouds, optical emission and absorption-line studies of the interstellar medium, and the role of supernovae in evolution of the interstellar medium and star formation. Offered jointly with Pomona and Joint Sciences. Prerequisites: Astronomy 62, Physics 52 or equivalent. (Offered alternate years; Spring)

121. COSMOLOGY AND EXTRAGALACTIC ASTROPHYSICS (2)

Staff. Examines the large-scale structures of the universe and the evolution of the universe from the Big Bang to the present epoch. Topics include alternate cosmologies, dark matter, cosmic background radiation, and formation and evolution of galaxies and clusters of galaxies. Offered jointly with Pomona and Joint Sciences. Prerequisites: Astronomy 62, Physics 52 or equivalent. (Offered alternate years; Spring)

122. HIGH ENERGY ASTROPHYSICS (2)

Esin. A survey of the physical processes and astrophysical systems that produce high-energy photons and presents a survey of the new ultraviolet, x-ray and gamma-ray observations. Topics include active galactic nuclei, black holes, neutron stars, supernova remnants and cosmic rays. Offered jointly with Pomona and Joint Sciences. Prerequisites: Astronomy 62, Physics 52 or equivalent. (Offered alternate years; Spring)

123. STELLAR STRUCTURE AND EVOLUTION (2)

Staff: A rigorous treatment of stellar atmospheres and radiative transfer. Topics include spectral line formation, stellar energy generation, evolution on and away from the main sequence, and the internal structures of stars and other self-gravitating objects. Offered jointly with Pomona and Joint Sciences. Prerequisites: Astronomy 62, Physics 52 or equivalent. (Offered alternate years; Spring)

124. PLANETARY ASTROPHYSICS (2)

Staff: The physics and chemistry of the planets, their natural satellites and the small bodies of the solar system. Topics include evolution and dynamics of planetary atmospheres; planetary interiors, alteration processes on planetary surfaces; the formation and dynamics of the solar system, evolution of small bodies and extra-solar systems. Half-course. Prerequisites: Astronomy 62. Offered jointly with HMC and Joint Sciences. (Offered alternate years; Spring)

INTERDISCIPLINARY PROGRAMS**JOINT MAJOR IN CHEMISTRY AND BIOLOGY**

The disciplines of biology and chemistry are undergoing remarkable and converging transformations. In response to these new developments, Harvey Mudd College has established a unique opportunity for undergraduate students at the interface of biology and chemistry.

The goal is to enable students to think at the interface, to effortlessly move back and forth between chemistry and biology. They will have the background to appreciate the biological context of their research questions and they will have mastered the chemistry fundamentals that underlie the properties and reactions of biomolecules. These successful students will be able to make connections and have insights that are difficult to obtain without a thorough training in both chemistry and biology. The program in Chemistry and Biology will capture the imaginations of talented HMC students and reinforce their abilities to think across disciplines.

Many schools have used the terms “biochemistry” or “biological chemistry” and some of the newer programs call themselves “chemical biology.” But since the boundaries between chemistry and biology as separate disciplines are rapidly dissolving, and students can choose to steer their studies in many directions, we chose to call it simply the “Joint Major in Chemistry and Biology.”

The Joint Major:

Chemistry 51. **PHYSICAL CHEMISTRY**

Chemistry 53. **PHYSICAL CHEMISTRY LABORATORY**

Chemistry 56. **CARBON COMPOUNDS**

Chemistry 58. **CARBON COMPOUNDS LABORATORY**

Chemistry 103. **CHEMICAL ANALYSIS**

Chemistry 105. **ORGANIC CHEMISTRY**

Chemistry 109. **CHEMICAL ANALYSIS LABORATORY**

Chemistry 111. **ORGANIC CHEMISTRY LABORATORY**

Biology 54. **BIOLOGY LABORATORY**

Biology 111. **MOLECULAR BIOLOGY LABORATORY**

Biology 113. **MOLECULAR BIOLOGY**

Biology/Chemistry 182. **CHEMISTRY IN LIVING SYSTEMS**

Biology/Chemistry 184. **METHODS IN BIOCHEMISTRY**

Biology/Chemistry 189. **TOPICS IN BIOCHEMISTRY AND MOLECULAR BIOLOGY**

One course selected from:

Biology 101. **COMPARATIVE PHYSIOLOGY**

Biology 108. **ECOLOGY AND ENVIRONMENTAL BIOLOGY**

Biology 109. **EVOLUTION**

Five elective credits of upper level Biology courses, to be selected by the student in consultation with her/his advisor. Prior permission from the Department of Biology is required.

Two successive semesters of Biology 191–192 **BIOLOGY COLLOQUIUM** and Chemistry 199 **CHEMISTRY SEMINAR** (four semesters total).

Two semesters (at least 6 credits total) of Senior Thesis Research (Biology 193–194, or Biology 195-196, or Chemistry 151–152). The senior thesis will have two readers, a mentor from one department and a co-reader from the other department.

NOTE: In order to optimize their opportunities and to enable individual flexibility, students may request to count other courses not currently listed as Biology electives. These other courses might include new Biology courses developed at HMC, cross-listed HMC courses (e.g., topics in biological engineering), and appropriate courses offered by other Claremont Colleges. Prior approval, granted by the faculties of Biology and Chemistry, will be required to substitute electives.

JOINT MAJOR IN COMPUTER SCIENCE AND MATHEMATICS

The Joint Major in Computer Science and Mathematics is cooperatively administered by the Computer Science and Mathematics Departments. The purpose of the Joint Major is to provide a program of study tailored to students who are interested in the interdisciplinary connections between computer science and mathematics. Depending on how electives are selected, the program described below would position successful majors for graduate studies in either computer science or mathematics, or for immediate employment.

The Joint Computer Science and Mathematics degree program has various components: the kernel courses in computer science and mathematics; more advanced courses in computer science and in mathematics; Clinic; and electives. Each of these components is described as follows.

Four kernel courses in computer science and mathematics:

Mathematics 55. **DISCRETE MATHEMATICS**

Computer Science 60. **PRINCIPLES OF COMPUTER SCIENCE** or

Computer Science 42. **PRINCIPLES AND PRACTICES OF COMPUTER SCIENCE**

Computer Science 81. **COMPUTABILITY AND LOGIC**

Mathematics 168 or Computer Science 140. **ALGORITHMS**

Three computer science courses:

Computer Science 70. **DATA STRUCTURES AND PROGRAM DEVELOPMENT**

Computer Science 105. **COMPUTER SYSTEMS**

Computer Science 131. **PROGRAMMING LANGUAGES**

Three mathematics courses:

Mathematics 131. **ANALYSIS I**

Mathematics 165. **NUMERICAL ANALYSIS** or Mathematics 164: **SCIENTIFIC COMPUTING**

Mathematics 171. **ABSTRACT ALGEBRA I**

Clinic

Two semesters are required, ordinarily taken during the senior year. Joint Majors will work on a Clinic project either from mathematics, computer science, joint computer science and mathematics 183-184 or on an interdisciplinary project. Software Development, Computer Science 121, is strongly recommended for students wishing to take Computer Science Clinic.

CSMT 183, 184. COMPUTER SCIENCE AND MATHEMATICS CLINIC I, II (3)

Staff: Team project in joint computer science and mathematics, with corporate affiliation.
Prerequisite: Computer Science 121. (Fall and Spring)

Electives

Eight units of upper-division technical electives: these electives can be from mathematics, computer science or other departments (but must include at least two units of mathematics and at least two units of computer science), and must be chosen with approval of the faculty advisors so that a coherent program is formed. Two semesters of senior thesis research can count toward this requirement. Note that Complexity Theory can be taken as either Mathematics 167 or Computer Science 142.

Colloquia

Students are required to attend two semesters of Computer Science Colloquium (Computer Science 195), one semester of Mathematics Colloquium (Mathematics 199) and one semester of Mathematics Forum (Mathematics 198).

Students in the Joint Major program will have faculty advisors from both the Mathematics and the Computer Science departments. For further descriptions of the computer science and mathematics programs, please refer to their separate sections in this catalogue.

MATHEMATICAL BIOLOGY

Mathematical and computational components are vital to many areas of contemporary biological research, such as genomics, molecular modeling, structural biology, ecology, evolutionary biology, and systems analysis of neurobiology, physiology and metabolism. Students interested in the interface between biology and mathematics may pursue the Mathematical Biology Major, which is jointly administered by the Departments of Biology and Mathematics.

The Mathematical Biology Major prepares graduates for further study in either biology or applied mathematics or for employment in industry. HMC's Common Core provides mathematical biology majors with a strong multidisciplinary foundation, and the College offers many opportunities for students to engage in interdisciplinary research in biomathematics and quantitative biology. Students who choose this major become immersed in the scientific and intellectual cultures of both biology and mathematics, and the major is sufficiently flexible to allow students to concentrate in a particular area of mathematical biology. Students in this major have both a Biology advisor and a Mathematics advisor, who will help them plan a program tailored to their interests and goals.

Mathematical Biology Major Requirements

Mathematics (10 units)—

Mathematics 55. **DISCRETE MATHEMATICS** (3)

Mathematics 131. **ANALYSIS I** (3)

Two mathematics electives (4 units); recommended courses include

Mathematics 106. **COMBINATORICS**

Mathematics 120. **CHIRALITY**

Mathematics 151. **PROBABILITY**

Mathematics 152. **MATHEMATICAL STATISTICS**

Mathematics 156. **STOCHASTIC PROCESSES**

Mathematics 158. **APPLIED STATISTICS**

Mathematics 159. **DESIGN AND ANALYSIS OF EXPERIMENTS**

Mathematics 173. **ADVANCED LINEAR ALGEBRA**

Mathematics 180. **APPLIED ANALYSIS**

Mathematics 181. **DYNAMICAL SYSTEMS**

Mathematics 182. **PARTIAL DIFFERENTIAL EQUATIONS**

Mathematics 185. **WAVELETS**

Mathematics 187. **OPERATIONS RESEARCH**

Mathematics 188. **SOCIAL CHOICE AND DECISION MAKING**

Biology (15 units)—

Biology 54. **BIOLOGY LABORATORY** (1 unit)

Three of the following four courses (9 units)

Biology 101. **COMPARATIVE PHYSIOLOGY**

Biology 108. **ECOLOGY AND ENVIRONMENTAL BIOLOGY**

Biology 109. **EVOLUTIONARY BIOLOGY**

Biology 113. **MOLECULAR BIOLOGY**

Two biology electives (one seminar and one lab, 5 units)

Computation (3 units)—One of the following:

Mathematics 164. **SCIENTIFIC COMPUTING** (3) or

Mathematics 165. **NUMERICAL ANALYSIS** (3) or

Mathematics 168/Computer Science 140. **ALGORITHMS** (3) or

Biology 188. **COMPUTATIONAL BIOLOGY** (3) or

another computation course with approval of the advisors

Mathematical Biology (4 units)—

Mathematics 118. **MATHEMATICAL BIOLOGY I** (2)

Mathematics 119. **MATHEMATICAL BIOLOGY II** (2)

Additional Requirements (9 units)—

One technical elective, chosen in consultation with student's advisor (3 units). The elective will typically be an additional mathematics or biology course, but can be another technical course that strengthens the student's area of interest. A few examples of the possible courses are:

Biology 153. **BIOSTATISTICS**

Computer Science 60. **PRINCIPLES OF COMPUTER SCIENCE** or

Computer Science 42. **PRINCIPLES AND PRACTICES OF COMPUTER SCIENCE**

Computer Science 152. **NEURAL NETWORKS**

Chemistry 51. **PHYSICAL CHEMISTRY: THERMODYNAMICS AND KINETICS**

Chemistry 56. **CARBON COMPOUNDS**

Biology/Chemistry 182. **CHEMISTRY IN LIVING SYSTEMS**

Two semesters of Senior Thesis Research (Biology 193–194 or Mathematics 197) or Clinic (6 units)

Colloquia

Biology 191–192: **BIOLOGY COLLOQUIUM** (two semesters) and

Mathematics 198, 199: Two semesters of Mathematics Colloquium (Mathematics 199) or one semester of Mathematics 199 and one semester of Mathematics Forum (Mathematics 198).

For further information, contact the mathematical biology advisors Professors Stephen Adolph (Biology), Lisette de Pillis (Mathematics), and Jon Jacobsen (Mathematics).

OTHER PROGRAMS

INDIVIDUAL PROGRAM OF STUDIES

Some students find that concentration in one of the majors offered at HMC does not meet their educational goals. As an alternative, any student may devise an individual program of study (IPS) designed to serve his/her academic interests. An IPS program is initiated by the student; it must be consistent with the nature and strengths of the College, but it may cross departmental and even college lines.

An individual program of study must have the following characteristics:

(1) The program must be constructed predominantly from the disciplines of science and engineering and be consistent with the purposes of Harvey Mudd College. It must differ from the other majors in a significant way and must have the approval of a faculty member and the dean of faculty. Each student in the program must have two faculty advisors, one from the Department of Humanities, Social Sciences, and the Arts and one from one of the technical departments.

(2) The program should contain at least 14 courses (42 credit hours) that make up a coherent set. Flexibility to choose among a large number of courses should not be at the expense of depth of concentration. Thus, at least two of the courses of this requirement should be taken in each of the last four semesters, and at least three of the courses should constitute a sequence.

(3) At least seven of the courses submitted under requirement (2) above must be taken at Harvey Mudd College.

(4) A student may not enter IPS after the sixth semester without prior approval by the Scholarly Standing Committee.

Many individual programs of study are interdisciplinary in nature. For example, a program may center on a field combining two of the traditional majors or on a field in science or engineering that is only partially covered by one of the majors. Alternatively, a program may seek to relate mathematics, physical science or engineering to an area of the social sciences or humanities. As illustrations of these possibilities, students have designed programs in architecture, environmental studies, geology, and politics and technology.

OFF-CAMPUS MAJOR

Students may also choose to complete an off-campus major at one of the other Claremont Colleges in order to satisfy the “major” component of the curriculum. In this case, the student must also complete a minor in one of the Harvey Mudd College major-granting departments, along with all other graduation requirements, including the Common Core and the program in Humanities, Social Sciences, and the Arts.

An off-campus major (OCM) is overseen by the Associate Dean for Academic Affairs. A student contemplating an OCM in lieu of a regular HMC major should consult with the Associate Dean about the application process. Since the requirements of the other college may be less than the HMC requirements for an OCM (10 courses), it is important that the student begin this consultation early. All students taking off-campus majors will be required to write a senior thesis or engage in some approved capstone experience (e.g., research, Clinic, internship) as well as completing a technical minor with one of the HMC major departments. In cases where courses in the off-campus major overlap with either or both of the HMC humanities, social sciences and the arts concentration or the HMC minor, up to four overlapping courses may be allowed to satisfy more than one of these departmental graduation requirements. Students are not allowed to seek off-campus majors that are offered as on-campus HMC majors.

MINORS

A minor is available only to students electing an OCM in lieu of a regular HMC major.

Biology: Biology 52 (required in Core), Biology 54, four additional biology courses, at least one of which must be a laboratory course. These courses are chosen with the approval of the student's biology advisor and are normally taken at HMC.

Chemistry: A minor in chemistry shall consist of a coherent group of at least four non-laboratory courses beyond the required Core in two or more areas of chemistry, i.e. analytical, biochemistry, inorganic, organic and physical. In addition, the minor must include laboratories in at least two different areas beyond Core chemistry and Carbon Compounds laboratories (Chemistry 24 and Chemistry 58, respectively). The minor must be approved by the minor advisor.

Computer Science: Mathematics 55, Computer Science 60 or Computer Science 42, Computer Science 140; one of the following: Computer Science 105, Computer Science 121, Computer Science 131, Computer Science 142; and any other upper division Computer Science course chosen with the consultation and approval of the minor advisor.

Engineering: The Engineering minor follows the same three-part model as the major. Students must complete seven engineering courses, as follows:

- Engineering Sciences (2): One of Engineering 82, 83, 84, 85 or 106 and one follow-on course in the same discipline as the first; and
- Engineering Systems (2): Engineering 59 (taken as part of the College's Common Core); and E101 and Design and Professional Practice (3); One of Engineering 4 or 111; and Engineering 8 and 80.

Mathematics: The student will propose a program designed in consultation with his/her mathematics advisor. Proposals must be approved by the Department of Mathematics Curriculum Committee and should consist of any four upper division Mathematics courses (to include Mathematics 55) which form a coherent concentration or survey program. At least three must be HMC or HMC cooperative courses. Mathematics Clinic and Senior Thesis are normally excluded.

Physics: Physics 52, Quantum Physics (3 units), and at least nine additional units of physics or astronomy chosen with the help of a physics advisor.

DUAL DEGREE PROGRAMS

Harvey Mudd College is currently participating in four dual degree programs with other members of The Claremont Colleges:

3-2 Program in Economics and Engineering with Claremont McKenna College

HMC offers a 3-2 Program in Economics and Engineering in cooperation with Claremont McKenna College. The program is designed for students who want a liberal arts background, with emphasis on economics and management, and an engineering major. The students spend

their first three years at Claremont McKenna College studying mathematics, science, economics, management and general education courses. At the end of the junior year, they may apply as transfer students. Accepted students must complete HMC's requirements for general education and for the engineering major. Because curricular expectations for the 3-2 transfer program are specific, potential applicants are strongly encouraged to consult with the Harvey Mudd College Office of Admission as well as the chairperson of the Department of Engineering.

3-2 Program in Engineering with Scripps College

HMC also has a 3-2 program in Engineering with Scripps College. The 3-2 Program with Scripps College does not include the emphasis on economics. The students reside at Scripps College for their first three years and cover a broad range of courses with emphasis in mathematics and science. Students accepted into the 3-2 program must complete HMC's requirements for general education and for the engineering major. Because curricular expectations for the 3-2 transfer program are specific, potential applicants are strongly encouraged to consult with the HMC Office of Admission as well as the chairperson of the Department of Engineering.

4+1 B.S. + M.B.A. Program

Harvey Mudd College has an arrangement with the Peter F. Drucker and Masatoshi Ito Graduate School of Management at the Claremont Graduate University whereby qualified students can earn an M.B.A. within 15 months of graduation from HMC. Participation in this program will require early planning so that courses appropriate to both the HMC and Drucker requirements will be taken. Interested students should consult with Professor Gary Evans before the middle of their sophomore year.

4+1 B.S. + M.S.I.S. Program

Harvey Mudd College has an arrangement with the School of Information Science at the Claremont Graduate University whereby qualified students can earn an M.S.I.S. in the year after their graduation from HMC. Interested students should discuss this option with their faculty advisor during their sophomore year. The advisor and the student should then consult with the dean of the School of Information Science.

GRADUATE COURSES FOR UNDERGRADUATES

Most graduate courses are open to qualified undergraduates with the permission of the instructor.

The following course is open to all undergraduates at The Claremont Colleges:

Education 170G CG. INTRODUCTION TO PUBLIC SCHOOL TEACHING

Students interested in pre-college teaching should contact the Teacher Education Program at CGU to arrange for courses that will meet the requirements for a teaching credential in California.

AEROSPACE STUDIES/AFROTC (AS)

The following courses are offered on the Harvey Mudd College campus by instructors from the Air Force ROTC under an agreement with the University of Southern California. A total of six credit units from Aerospace Studies 400-401 can be used toward the credit hour requirements for HMC graduation, but the credits received by those units are not computed as part of the HMC grade point average. All courses are recorded with a letter grade, except Leadership Laboratory courses which are on a pass/fail basis. See the Air Force ROTC site for more information on the program and available scholarships or contact the Detachment 060 Unit Admissions Officer at 213.740.2670.

100–101. THE AIR FORCE TODAY (1; 0 for HMC students)

Staff. A survey course which explores major topics relating to the Air Force and defense. It focuses on the organizational structure and missions of Air Force organizations; officership and

professionalism; and includes an introduction to communicative skills. A weekly Leadership Laboratory affords students an opportunity to practice Air Force customs and courtesies, including physical fitness and drill and ceremonies.

200–201. USAF AIR AND SPACE POWER (1; 0 for HMC students)

Staff. This course focuses on factors contributing to the development of air power from its earliest beginnings through two world wars, the evolution of air power concepts and doctrine, and an assessment of communicative skills. An additional Leadership Laboratory consisting of Air Force customs and courtesies, Air Force environment, drill and ceremonies, and field training orientation is mandatory.

300–301. AIR FORCE LEADERSHIP AND MANAGEMENT (3; 0 for HMC students)

Staff. A study of leadership and quality management fundamentals, professional knowledge, leadership ethics and communicative skills required of an Air Force junior officer. Case studies are used to examine Air Force leadership and management situations as a means of demonstrating and exercising practical applications of the concepts being studied. A mandatory Leadership Laboratory complements this course by providing advanced leadership experiences in officer-type activities, giving students the opportunity to apply leadership and management principles of this course.

400–401. NATIONAL SECURITY FORCES IN CONTEMPORARY AMERICAN SOCIETY (3)

Staff. This course examines the need for national security, analyzes the evolution and formulation of the American defense policy, strategy and joint doctrine; investigates the methods for managing conflict; overviews regional security, arms control and terrorism. Special topics of interest focus on the military professionalism. Within this structure, continued emphasis is given to the refinement of communicative skills. An additional Leadership Laboratory consisting primarily of advanced leadership experience in officer-type activities is mandatory.

While no credit is given, students in Air Force ROTC must also pass the following courses:

110–111. LEADERSHIP LABORATORY I (0)

Staff. Introduction to the military experience focusing on customs and courtesies, physical fitness and competitive sports, drill and ceremonies, and the environment of an Air Force officer.

210–211. LEADERSHIP LABORATORY II (0)

Staff. Introduction to the military experience focusing on customs and courtesies, physical fitness and competitive sports, drill and ceremonies, and the environment of an Air Force officer.

310–311. LEADERSHIP LABORATORY III (0)

Staff. Practical introduction to Air Force leadership. Course focuses on military communicative skills, group dynamics, and applications of theories of leadership and management and physical fitness and competitive sports.

410–411. LEADERSHIP LABORATORY IV (0)

Staff. Advanced Air Force leadership experiences. Course focuses on the practical development of the Air Force officer through command and staff positions with the Cadet Corps. Curriculum includes continuing emphasis on physical fitness and competitive sports.

510–511. LEADERSHIP LABORATORY V (0)

610–611. LEADERSHIP LABORATORY VI (0)

710–711. LEADERSHIP LABORATORY VII (0)

810–811. LEADERSHIP LABORATORY VIII (0)

REGULATIONS

ACADEMIC REGULATIONS

Academic regulations are established by the faculty. Unless otherwise indicated in the College catalogue, exceptions to these regulations require the approval of the Scholarly Standing Committee. Written petitions for exceptions should be submitted to the Registrar for the committee. It is the student's responsibility to make certain that all degree requirements are satisfied. Students may elect to complete the graduation requirements stated in any catalogue in effect during their enrollment at the College, but they may not mix provisions from various catalogues.

GRADUATION REQUIREMENTS

In order to be recommended by the faculty for the Bachelor of Science degree, students are required to complete satisfactorily a minimum of 128 credit hours of courses (including approved transfer credits for courses taken at other colleges). Students must complete the requirements of each of the three parts of the curriculum as listed in the Academic Program section of this catalogue. They must also complete the physical education requirement.

A student enrolled for at least 12 credit hours in one semester is considered a full-time student for that semester. In order to qualify for a degree, a student must spend his/her last four semesters full-time and complete satisfactorily at least 12 credit hours in the last of these semesters. For those considering study abroad, see Study Abroad.

No student may be enrolled at Harvey Mudd College for more than 10 semesters.

To graduate, a student must earn a final cumulative grade point average (GPA) of C (2.000) or better. This cumulative GPA determines rank in class at graduation. In addition, he/she must earn a cumulative GPA of 2.000 or better in all courses required by the major, an individual program of studies or a technical minor for the off-campus major.

A student who wishes to graduate at the end of a specific semester must make an application to do so. This application is due with the pre-registration materials for that final semester, but it must be submitted no later than the end of the official final semester pre-registration period as indicated on the College academic calendar. Applications that are received later than this time will be interpreted as applying to the semester following that semester.

A student is recommended by the faculty for a degree only when she/he has completed all academic obligations to the College. A diploma is awarded by the Board of Trustees only when the student has satisfied all disciplinary and financial obligations to the College. The HMC Student Handbook contains more information regarding student disciplinary obligations in the Non-Academic Graduation Requirement policy.

GRADING REGULATIONS

The final grade of a student in each course is determined by the instructor. All grades are due to the Office of the Registrar by the appropriate (regular or senior) deadline date announced in the catalogue. The deadline also applies to the grade "Incomplete" (INC) unless otherwise approved by the Associate Dean for Academic Affairs. (See the description of "Incomplete Grade.") In case an error has been made in determining, reporting or recording the grade in a course taken at the College, a change of grade form must be submitted to the Registrar by the instructor. If the change of grade occurs beyond the end of the following semester, the Registrar must submit the request for change to the Scholarly Standing Committee for its approval.

Protests about grades in courses taken at other Claremont Colleges are handled by the procedures of the College sponsoring the course, except in cases of alleged academic dishonesty.

For first-year students in their first semester of residence at HMC, all courses numbered below 50 are graded on the High Pass, Pass and No Credit scale. All courses numbered 50 and above are graded on the letter grade scale, except when noted.

First-year courses are those numbered below 50. Lower division courses are those numbered 50 to 99. Upper division courses are those numbered 100 and above.

Grade Descriptions. Grades indicate both performance in the work of the course and comprehension of the subject matter. They are defined as follows:

- A** Excellent; 4 grade points per unit of credit.
- B** Good; 3 grade points per unit of credit.
- C** Fair; 2 grade points per unit of credit.
- D** Barely passing; 1 grade point per unit of credit.
- F** Failure; no grade points.
- N** The grade given at the end of the first semester of a two-semester course. The final grade is assigned at the end of the second semester. A two-semester course as designated by the Curriculum Committee is defined as a year-long two-course sequence.

P Passing; satisfactory performance and mastery of course material for first-semester, first-year courses and when course grades are given on a pass/fail or pass/no credit basis.

HP High Pass; superior performance and mastery of course material; first-semester, first-year courses only.

NC No Credit; first-semester, first-year courses courses and when course grades are given on pass/no credit basis. Students must repeat first-year courses until the course is passed.

INC Incomplete; The student's work for the course has not been completed, an extension of time to complete the course has been approved by the instructor and the Associate Dean for Academic Affairs, and a grade has not been reported.

W Withdrawn; The course was dropped after the Last Day to Drop.

Grades of A-, B+, B-, C+, C-, and D+ may also be awarded for courses graded on the letter grade system. There is no grade of A+ or D-.

During the course, a code of IP (In Progress) is listed for a course in the grade field for reporting purposes. If no grade is submitted at the end of the course, a code of NR (Not Reported) is listed until a final grade is submitted by the instructor.

Other codes which may appear on a transcript for a course include:

- AP** Placement Credit; unit credit awarded.
- EX** Passed by examination; unit credit awarded.

Computation of Grade Point Averages. Courses graded P, HP, NC or N are omitted in computing grade point averages. A grade of INC is computed with zero grade points until changed and is not included in the calculation of the semester or cumulative grade point averages. Any grade of F is included when computing the grade point average, even if the course is taken again with a passing grade. In computing grade point averages for transfer students, all HMC courses are counted regardless of when they were taken. Courses at the other Claremont Colleges are counted only if taken while enrolled as an HMC student. Grade point averages are truncated after the third decimal place.

Incomplete Grade. An Incomplete is given only with the approval of the instructor and the Associate Dean for Academic Affairs. An Incomplete is given only when illness or special circumstances justify the granting of the additional time for completion of the work. A student's performance in the course up to the time he/she became ill or when his/her work was otherwise disrupted is considered in granting an Incomplete. The Incomplete is removed if all work is completed by the time agreed upon by the instructor, the student and the Associate Dean for Academic Affairs and a final grade has been submitted by the instructor to the Registrar's Office. If the outstanding coursework is not submitted to the instructor by the agreed upon deadline, an Incomplete becomes an F or NC depending on the grading option.

Changing of Courses—Add/Drop/Withdrawal. A student may add a course until the official add date for the instructional period for that course, if adding the course will not cause

an overload. Instructor permission is required to add a course starting with the first day of the instructional period (e.g., full semester or half semester). Permission to overload is obtained from the Associate Dean for Academic Affairs. After the official add date deadline, a student may request a late add by submitting a petition to the Scholarly Standing Committee through the Office of the Registrar. A student may drop from any course without it being listed on his/her transcript so long as he or she remains enrolled in at least 12 credit hours and the drop occurs before the deadline determined by the academic calendar. If the course is part of the Core Program, the student must obtain the signature of the Associate Dean for Academic Affairs for the purpose of verifying consultation. After the official drop deadline a student may request a withdrawal from a course by submitting a petition to the Scholarly Standing Committee through the Office of the Registrar. If the committee grants the withdrawal, the transcript will show a grade of W under the course in question. If the withdrawal is denied, the student must remain in the course and the grade earned is recorded on the transcript.

Involuntary Disenrollment. Students who, after warning from their instructor, continue to engage in conduct that results in the substantial impairment of teaching or learning in a course, may be involuntarily disenrolled from the course by the Dean of Faculty. The full text of the policy on Involuntary Disenrollment from a Course appears in the HMC Student Handbook.

Completion of Required Course Work. The last due date for the submission of work required to complete a course may be set by the instructor, but may not be later than the date set by the Registrar for the final examination in the course whether or not a final is given on the date assigned.

Pass/Fail. After the first semester of the first year, a student may select one course or the equivalent of 3 units (in addition to physical education courses) each semester for which he/she will receive a grade of P (Pass) or F (Fail). However, none of the technical core requirements may be taken on a pass/fail basis (except by departmental approval). In addition, departments may establish regulations about which of the courses required for the major may be taken on a pass/fail basis. Not more than one course (or the equivalent of 3 units) each academic year from among any one department's course offerings may be selected on the pass/fail basis. Approval in writing must be obtained from the course instructor and the student's advisor. The selection of a pass/fail course or the change to letter grades cannot be made after the last day for dropping from a course without academic penalty. A pass/fail course is omitted in computing grade averages unless the grade is "F." The grade "Pass" is equivalent to C- or better in a course regularly graded.

Course Deficiencies. Students are required to take their approved fitness PE course during the first year. After the first year, students must attempt all deficient first-year Core courses each time they are offered:

Chemistry 21, 22, 25 and 26, Computer Science 5, Humanities 1, Mathematics 11, 12, 13 and 14, and Physics 23, 24 and 28

or, if starting Fall 2010: Biology 52, Chemistry 23E, 23S, 23D, 24; Computer Science 5; HSA 10; Mathematics (25G or 25B), 35, 45; Physics 22, 23, 24; and Writing 1.

All such courses must be passed before the beginning of the junior year. All Core courses must be attempted by the end of the fifth semester. If a student fails or withdraws from any of Mathematics 61, 62, 63, 64 or 64A, Physics 51 or 53, Biology 52, or Engineering 59, the student must re-attempt that course at least once each academic year until it is passed. Beginning with the fifth semester, students must attempt all deficient Core courses each time they are offered during the academic year.

Grade Reports. Grades are not sent to students at the end of each semester by the Registrar. Grades are viewable on the student and faculty portals.

NOTIFICATION OF STUDENT RIGHTS

Per the Family Educational Rights and Privacy Act (FERPA), students at Harvey Mudd College are guaranteed certain rights in regard to the privacy of information from their education records. These rights are as follows:

The right to inspect and review the student's education records.

Students should submit a written request to the Registrar identifying the record(s) they wish to inspect. The Registrar or, at the direction of the Registrar, another appropriate College staff member will make arrangements for access and notify the student of the time and place where the records may be inspected. Applicants for admission who wish to review or to release to a third party their application documents (excepting letters of recommendation) should submit a written request to the Office of Admission identifying the records they wish to inspect (or have released to a designated third party).

The right to request the amendment of the student's education records that the student believes is inaccurate, misleading or an invasion of privacy. Students may ask the College to amend a record that they believe is inaccurate or misleading. They should write the College official responsible for the record, clearly identify the part of the record they want changed and specify why it is inaccurate, misleading or an invasion of privacy. If the College decides not to amend the record as requested by the student, the College will notify the student of the decision and advise the student of his or her right to a hearing regarding the request for amendment. Hearings will be conducted by the appropriate College hearing body. Students also have a right to have their personal written Statement submitted and retained by the recordkeeper for as long as the objectionable record is retained. Should the objectionable record be disclosed, the recordkeeper must also disclose the student's statement. Grades are not covered by this right-to-request amendment.

The right to consent to disclosures of personally identifiable information contained in the student's education records, except to the extent that FERPA authorizes disclosure without consent. One exception, which permits disclosure without consent, is disclosure to school officials with legitimate educational interests. A school official is defined as a person employed by the College, one of the other Claremont Colleges, or the Claremont University Consortium in an administrative, supervisory, academic (including faculty); or support staff position (including Campus Safety and Student Health Center staff); a person or company with whom the College has contracted (such as an attorney, auditor or collection agent); a person serving on the board of trustees; or a person assisting another school official in performing his or her tasks. A school official has a legitimate educational interest if the official needs to review an education record in order to fulfill his or her professional responsibility.

Upon request, the College discloses education records without consent to officials of another school at which a student has informed the College that she/he seeks, intends to enroll and is enrolled. Some scholarship donors will require that students authorize disclosure to them of information pertaining to the student's academic progress. Acceptance of these scholarship funds from such donors will be considered as granting consent to the College to make these disclosures.

The right to request that the College not disclose directory and non-directory information. At its discretion, Harvey Mudd College may confirm or disclose "directory information" to the general public. The College defines "directory information" in accordance with FERPA as follows:

1. Name
2. Campus mailing address
3. Major field of study
4. Dates of attendance and classification
5. Degrees and/or awards received

6. Previous academic institutions attended
7. Date of birth
8. Campus e-mail address

Under certain circumstances, home and campus telephone numbers may be released. The CMS Athletic Department may also release information about a student in compliance with normal practices for “team rosters,” including height, weight and hometown. Per the Solomon Amendment, the College releases recruiting information to military recruiters. Recruiting information includes directory information that has not been restricted and may include year in school, place of birth and telephone number.

Students may request that their directory information not be released by signing a non-disclosure form within two weeks of the start of any semester. All written requests for non-disclosure of directory information by current students will be honored until revoked by the students in writing. The College accepts requests for non-disclosure from alumni nad honors such requests until revoked by the former student in writing. Harvey Mudd College assumes that failure on the part of any student to specifically request the withholding of directory information indicates individual approval for disclosure.

The right to file a complaint with the U.S. Department of Education concerning alleged failures by the College to comply with the requirements of FERPA. Complaints should be directed in writing to the following address:

Family Policy Compliance Office
U.S. Department of Education
400 Maryland Avenue, S.W.
Washington, DC 20202-5920

HONORS AND AWARDS

Graduation with Distinction and High Distinction. These honors are awarded for scholarly achievement at Harvey Mudd College. Students qualify for distinction if they have obtained a cumulative grade point average of at least 3.300; and for high distinction if their cumulative grade point average is at least 3.700; or if, by vote of the faculty, they are selected to receive either award.

Graduation with Honors. The faculty, usually upon recommendation of a department, may award honors to a graduating student for outstanding achievement. A copy of a department's criteria may be obtained from the department chair.

Dean's List. The Dean's List consists of the names of those students who have obtained a grade point average of 3.000 or better while taking 15 or more units of credit, at least 12 of which are graded by letter grades A to F. Those students on the Dean's List have a citation on their transcript for the corresponding semester.

Letters of Commendation. Letters of commendation may be used to recognize exceptional student achievement in courses. Such letters are cited on students' transcripts. First-year students with high academic achievement are given formal recognition by the Associate Dean for Academic Affairs.

ACADEMIC STANDING

The record of every student is reviewed at the end of each semester and at any other time that such a review seems pertinent. The Scholarly Standing Committee examines the records of those students who are not making satisfactory progress toward a degree. Such students are subject to notification and change of academic status as outlined in the following sections. Criteria for determining “satisfactory progress” include the grade point average in courses required for the major, the overall grade point average and grades for the latest semester's work. The notification sent to the student includes the reasons for the action and the prerequisites for return to regular status.

A student's academic standing is considered by faculty members and administrators when hiring or appointing students to time-consuming jobs and to positions where they serve as role models such as proctors, orientation directors and sponsors, graders, tutors or consultants.

Warning. The status "On Warning" is applied to students whose academic deficiencies do not warrant more stringent action. Students placed "On Warning" remain in good academic standing, but are thereby notified that improved performance is expected. Ordinarily, a student whose semester GPA falls between 1.800 and 2.000 is placed "On Warning." A student with a Core course deficiency is also placed "On Warning" until the deficient course is passed.

Probation. Probation is a formal change of academic status, appearing on academic records, for example, and indicating that the student must make substantial improvement or face the possibility of being declared ineligible to re-register. A student on probation is considered not in good standing. Ordinarily, a student whose semester GPA falls below 1.800 is placed on "Probation."

Ineligible To Re-Register (ITR). A student in one of the following categories may be declared ineligible to re-register at Harvey Mudd College:

1. A student who is on probation and who fails to make substantial improvement in his/her academic record. (The amount of improvement expected is generally specified at the time probationary status is imposed.)
2. A student who satisfactorily completes fewer than eight units during any semester. (Students receiving a grade of Incomplete may have their evaluations postponed until the Incomplete is finished.)
3. A student whose cumulative grade point average is less than 2.000, or whose semester grade point average falls below 2.000 for two successive semesters.
4. A junior or senior whose cumulative grade point average in the major is less than 2.000.
5. A student who has not passed all first-year Core courses (see Course Deficiencies on page 106) before the beginning of the fifth semester.
6. A student who has not attempted all Core courses by the end of the fifth semester. See Course Deficiencies on page 106.
7. A student who fails any Core course three or more times.
8. A student who is deficient in a Core course and has not registered for that course as specified in the Course Deficiencies section (page 106).

Mid-Term Warnings. Mid-term warnings may be given for unsatisfactory progress in a course.

Athletic Eligibility. To meet the eligibility requirements established by the College and the National Collegiate Athletic Association (NCAA), students who intend to participate in inter-collegiate athletics must be enrolled in a minimum full-time program of study, maintain good academic standing and sustain satisfactory progress toward a degree. Any Harvey Mudd College student enrolled in 12 semester units (a full-time student) and not on academic probation meets these "full-time program," "good academic standing," and "satisfactory progress" requirements.

Any student who has been placed on academic probation is ineligible for participation. All students have the right to appeal to the Scholarly Standing Committee for release from probation prior to the end of the semester. While approval of such a request is rare, the decision of the Committee would be based on performance indicators (i.e. mid-term exams).

EVALUATION OF THE PREVIOUS EDUCATION AND TRAINING OF VETERANS

In accordance with CFR§21.4253(d)(3), Harvey Mudd College will conduct an evaluation of the previous education and training of veterans, grant appropriate credit, shorten the veteran or eligible person's duration of degree course proportionately, and notify the Veterans Administration and student accordingly.

STANDARD OF PROGRESS FOR VETERANS

In accordance with CFR§21.4253(d)(1)(I), any veteran or eligible person who remains on pro-

bation for grade point deficiency below a 2.000 cumulative GPA beyond two semesters, will have his/her veteran's benefits discontinued. Certification of benefits will also be terminated.

ADVANCED PLACEMENT AND CREDIT BY EXAMINATION

In general even introductory courses at HMC go significantly beyond a normal AP course. As a result success in AP courses does not guarantee advanced placement here, although some departments offer opportunities to place out of certain courses. The rules for advanced placement are listed on each department's website.

CHALLENGING COURSES BY EXAMINATION

A student in the College may also challenge some courses by examination. Since the courses that may be challenged are at the discretion of the department chair, a student must obtain the permission of the chair or his/her assignee before noon of the first day of classes of the semester in which he/she wishes to be examined. Mastery of material covered in the course must be demonstrated in order to have a requirement waived while a very high level of mastery must be demonstrated for credit to be earned. The level of these standards will be decided by the department chair. Some may choose not to award any credit but to waive a requirement allowing a student to take a more advanced course instead of the challenged one. The standards are set high because it is believed that there is more than just knowledge of content to be gained from engaged participation in a course. A student may challenge a given course only once.

Chemistry: A placement examination is available for students who feel they have a strong background in chemistry. A high standard of performance earns unit credit for Chemistry 23S and/or Chemistry 23E. A second examination is available for Chemistry 23D. The first examination is offered in the fall during the week before classes begin. The second examination is offered by prior arrangement with the chair of the department.

Mathematics: Advanced placement for courses can be earned by examination prior to enrolling in the course. These exams are arranged in consultation with a representative of the Department of Mathematics, typically prior to the start of the Fall semester.

Physics: Passing a departmental exam earns credit for Physics 24 and possibly Physics 23.

Transfer Credit for Transfer Students: Credit is given to transfer students for course work completed at other colleges that is reasonably equivalent to work offered at Harvey Mudd College. The amount of such credit is determined by the appropriate departments. Only C or better work is transferable.

Transcripts are evaluated at the time of admission so that students are informed at the time of acceptance what unit credit they have been awarded. Students will be asked to furnish course descriptions to facilitate this evaluation process. Courses underway are evaluated "subject to successful completion." Occasionally, transfer students are asked to take departmental examinations to establish credit.

When portions of the required Humanities, Social Sciences, and the Arts (HSA) program remain to be taken, up to half of these may be taken at other Claremont Colleges. In special cases of advanced admission to HMC where few, if any, required HSA courses remain, the student must take one HSA course per semester. These are elective courses and up to half of them may be taken at other Claremont Colleges.

COURSE ELECTIONS

Faculty Approvals. Prior to course registration and when course changes are made, students must have their course selections approved by their faculty advisors. In addition, all course selections for humanities and social science electives must be approved by the student's advisor in the Department of Humanities, Social Sciences, and the Arts.

Overloads. In exceptional circumstances, a student with a record of successful academic

performance may take more than 18 credit hours in a semester. The guidelines for overload approval are as follows:

Overloads for First-year. First-year students must request permission for overloads through a written petition to the Associate Dean for Academic Affairs. Petition instructions and deadlines are available from the Office of Academic Affairs.

Overloads for Sophomores, Juniors and Seniors.

1. For overloads of 19 1/2 units or fewer: Overload approval requires the signature(s) of your academic advisors and a petition approved by the Associate Dean for Academic Affairs. Approval is granted provided previous semester GPA is at least 3.000 and all advisors agree.

2. Overload is 20 to 21 units: Overload approval requires the signature(s) of your academic advisors and a petition approved by the Associate Dean for Academic Affairs. A GPA of 3.000 in the preceding semester is required, as is evidence of the exceptional circumstances arguing for an overload. The following may constitute exceptional circumstances:

- Unique opportunity to take complementary or synergizing courses
- Unique opportunity to work with a particular faculty member (i.e. a visitor) or course (i.e. an experimental offering)
- Scheduling difficulties created by future or past semesters abroad or on exchange
- Unit credit needs for graduation within eight semesters.

Students are free to make the case for other exceptional circumstances in their petitions. The simple desire to take a course, however, does not constitute an exceptional circumstance, nor does evidence of a student's ability to "handle" additional coursework. The decision made by the Associate Dean for Academic Affairs regarding overload petitions is final.

3. Overload of more than 21 units: Granted only for the justification of unit credit needed for graduation in eight semesters and only then with the recommendation of all academic advisors.

Petition forms are available from the Office of the Associate Dean for Academic Affairs.

Course Changes. A required course may be replaced by a course in a different area of study only with the consent in advance of the Scholarly Standing Committee and the chairs of the departments concerned.

Off-Campus Registration. Students may register for courses open to them in the other Claremont Colleges. Courses taken at the Claremont Graduate University are recorded with the units of credit indicated in its catalogue. Full courses taken at Claremont McKenna, Pitzer, Pomona and Scripps Colleges receive three units of credit, except those courses in science and mathematics for which a three-hour laboratory is indicated in the catalogue. In such cases, credit is determined by the appropriate HMC department. Unit credit for off-campus courses other than full courses is determined before registration by the Harvey Mudd College department involved.

Any course in which a student enrolls for credit, shown in the catalogue of any Claremont College, is indicated on the transcript with credit and grades recorded and is included in the calculation of the cumulative grade point average.

Directed Reading Courses. Directed reading courses are open to juniors and seniors only, and a student may take only one such course (or the equivalent of 3 units) each semester. Directed reading courses are also available during the summer by registration with the Claremont Summer Session. Such a course may not be used as a substitute for a required first-year or sophomore course.

Summer School Credit for Transfer. A student who wishes to attend a summer school outside of The Claremont Colleges and transfer credits to Harvey Mudd College must obtain permission in writing from the chair of the Harvey Mudd College department concerned prior to registering for the summer school. Upon completion of the summer session, the student should request the College to send an official transcript to the Registrar. Only C quality work or better is transferable. However, some departments set a minimum grade that must be received

in summer school courses, if they are to be used for transfer credit. Approved summer school courses are placed on the student's Harvey Mudd College academic record and may be counted as fulfilling distributive requirements upon consent of the department chair. Unit credit at Harvey Mudd College for such courses is generally the same as for equivalent courses at HMC except where adjustments must be made by the Registrar to equalize credits with the semester system at Harvey Mudd College. The grade obtained in a summer school course outside of The Claremont Colleges is not counted in determining the student's cumulative grade point average.

Foreign Languages. There are no undergraduate requirements in foreign languages. Students planning to go to graduate school, however, are reminded that a reading knowledge of German, French or Russian may be required as part of a program leading to an advanced degree.

FULL-TIME STATUS

A student enrolled for at least 12 credit hours in one semester is considered a full-time student for the semester. HMC degree-seeking students are full-time students, unless special permission is obtained to be enrolled in less than 12 credit hours. A student may request to be enrolled in less than 12 credit hours by petitioning the Scholarly Standing Committee through the Office of the Registrar.

CLASS ATTENDANCE

Students are expected to attend all classes and not to absent themselves without adequate reason. The regulation of class attendance is ultimately the responsibility of the faculty. Each instructor has the privilege of establishing specific regulations regarding attendance as may be appropriate for his or her particular course.

LEAVES OF ABSENCE AND WITHDRAWALS

A student who plans to leave the College should arrange a voluntary withdrawal with the Dean of Students or the Associate Dean for Academic Affairs.

Leaves of absence for stipulated periods may be granted by the Dean of Students or the Associate Dean for Academic Affairs; readmission is usually automatic upon application to the deans unless specific requirements were established for the return from the leave.

A student who has withdrawn from the College and wishes to be readmitted must apply to the Scholarly Standing Committee.

A student who withdraws or takes a leave of absence from the College before the semester course drop deadline will be noted as having withdrawn or taken a leave of absence with the previous semester's standing. No courses are listed on the transcript for the semester unless the course was completed before the leave date.

A student who withdraws or takes a leave of absence from the College after the semester course drop deadline, but by the last day of classes for that semester, receives a grade of W in all courses, which have not been already graded. The Registrar ascertains whether or not the student was in good standing.

A student who withdraws or takes a leave of absence from the College after the last day of classes for a given semester will still receive the grades earned in those courses in which he/she was enrolled at the time of leaving.

PROGRAM OF TRANSFER STUDIES

Under special circumstances, a student may apply to the Scholarly Standing Committee for admission to the program of transfer studies. The program of transfer studies provides a terminal semester during which the student is released from the usual course requirements in order to improve his/her academic standing and to prepare for transfer to another college at the end of the semester. Readmission to HMC is not normally permitted.

GENERAL REGULATIONS

Fees and Refunds. All charges (tuition, room, board, fees and deposits) must be paid in cash (\$U.S.), by checks drawn on American or Canadian banks, or money order (international, if appropriate). Descriptions of fees and deposits follow; arrangement for payment must be made prior to the service.

Course-Change Fee. The fee for any change in registration that is initiated by the student is \$5 per Course Add/Drop form. There is no fee charged for registration changes made during pre-registration, via the portal or before the start of the semester. There is no fee charged at any time for changes in registration for Physical Education classes. First-year, transfer, and foreign exchange students are not charged for changes in registration during their first two semesters.

Transcript Fee. A transcript request is submitted to the Office of the Registrar. A fee of \$2 is charged for each official transcript. A transcript is issued only when obligations to the College have been paid in full or satisfactory arrangements have been made to do so. A transcript is sent out only at a student's request. There is no charge for an unofficial transcript.

Class Fees. Individual classes may have additional fees associated with them. These fees are listed in the Schedule of Classes that is issued prior to pre-registration each semester. Class fees will be posted to student accounts and will be completely refunded if the drop is made on or before the last day to add classes. Class fees are non-refundable if drop/withdrawal is made after that date.

Damage Deposit/New Students. Half (\$150) of first year students' enrollment deposit (\$300) is automatically converted to a housing damage deposit that is returned to students when they graduate or permanently leave the College. Each year, residence hall damage charges are deducted from the deposit and students are billed to return the deposit to \$150. The other half of the enrollment deposit (\$150) becomes a housing deposit that is returned to students as a credit on their first bill. The enrollment deposit is non-refundable, and therefore the damage and housing deposits are non-refundable for new students who decide not to attend HMC.

Housing Deposit/Returning Students. Early in the spring semester, every student who wishes to live on campus the following year must submit a \$75 housing deposit to be eligible to participate in room draw. The housing deposit is returned as a credit on the first bill of the next year. A student who has completed the room draw procedure and then decides not to live on campus can contact Student Accounts for a refund. Also, students who will not live on campus for the fall semester may request that their deposit be held to cover spring housing or may request a refund and resubmit the deposit prior to the spring semester.

Refunds for Changes in Courseload to Less than Full Time. A student who wishes to change courseload to less than ten units must give notice by submitting a Course Add/Drop Form and a Scholarly Standing Committee Petition to the Office of the Registrar. Students whose petitions are approved within the first 30 days of the semester are refunded according to the number of units enrolled. No refunds are made after the first 30 days of the semester.

Refunds for Withdrawals During the Term. A student who wishes to withdraw from the College must give notice by completing a Withdrawal/Leave of Absence form with the Dean of Students or the Associate Dean for Academic Affairs, who then notifies the Registrar and the Office of Student Accounts. No refunds are made if the student withdraws without giving notice. A student receives a refund, less a pro rata reduction of any scholarship or grant, subject to the following:

1. A 100 percent refund of charges and fees is made if withdrawal occurs before the first day of classes.
2. A 75 percent refund of the tuition charge is made if withdrawal occurs before the 18th day of classes.

3. A 50 percent refund of the tuition charge is made if withdrawal occurs after the first 17 days of classes, but by the 30th day of class.
4. No refund of the tuition charge is made after the 30th day of class.
5. Refund of the board charge is on a pro-rata basis.
6. No refund of the room charges or fees.
7. Refunds are made by the College within 30 days of completion of the Withdrawal/Leave of Absence form by the Dean of Students or the Associate Dean for Academic Affairs.

Questions regarding withdrawal should be directed to the Dean of Students or the Associate Dean for Academic Affairs. Questions regarding the College's refund policy or procedure should be directed to the Office of Student Accounts.

Note: When a student leaves HMC prior to the end of a semester, the College determines whether a refund of charges is due as well as how much federal and institutional financial aid has been earned to pay for those charges. Refer to "Return of Federal Financial Aid Funds" on page 16 of the "Understanding Your Financial Aid Award" brochure provided by the Office of Financial Aid.

AUTOMOBILES AND MOTORCYCLES

Every student living on or off campus who owns or operates an automobile, motorcycle, motor scooter, moped or motorbike on the campuses of The Claremont Colleges must register the vehicle with the Campus Safety Department at the opening of each semester. Vehicles must have liability insurance and there is a parking fee of \$20 per semester for students. First-year students are prohibited from bringing or parking cars on campus. Exceptions may be made by contacting the Dean of Students Office.

STUDENT HEALTH SERVICE

The Claremont Colleges maintain a health service for students while college is in session. Two physicians and a staff of nurse practitioners provide office care at the Student Health Service Monday through Friday, from 8:00 a.m. to 5:00 p.m. with extended hours on Wednesdays. Charges are made for medicines, laboratory tests, special supplies and some elective treatment. Referrals for treatment by specialists in all fields can be arranged when needed. Outside consultation, hospitalization and surgery are arranged by the health service, but are not financed by the College and payment for them is a responsibility of the individual student. Health care service is available throughout the academic year with the exception of scheduled vacations. As part of its continuing wellness programs, the Health Service seeks to empower students to take responsibility for their own health and well-being.

An accident and hospital reimbursement plan is required for all students to protect against major costs if they are not covered by a family health insurance policy. This plan is designed to supplement the care provided by the health service. Premiums and coverage are described in a brochure available on the Student Health Service website.

MEDICAL REQUIREMENTS

The medical certificate required of all applicants prior to admission includes a physical examination, a tuberculin test, an X-ray of the chest within the preceding six months of those with a positive tuberculin test, and active immunization against tetanus, diphtheria, measles and rubella. Immunization against hepatitis B, meningococcal meningitis and chicken pox is also strongly recommended.

INSURANCE

The College does not assume responsibility for loss or damage to personal property belonging to students. Adequate insurance coverage is advised for everyone.

FINANCIAL AID

As specified by law, Harvey Mudd College monitors its aid recipients to ensure that they are maintaining satisfactory academic progress toward completion of their degree. Students are normally expected to graduate after eight semesters of enrollment at HMC or, for students who transfer into HMC from another institution, after the pre-designated number of semesters required to complete graduation requirements. As HMC students are generally eligible for only four years (or eight semesters) of financial assistance, normal academic progress must be maintained to ensure a timely graduation. Financial aid recipients should complete an average of 32 units per year to meet the graduation requirement of 128 units in four years and to remain eligible for financial aid. However, if there are circumstances that prevent degree completion within eight semesters, a student may apply for up to two additional semesters to complete the degree with financial aid. A student who wishes to pursue such an extension should consult with the Associate Dean for Academic Affairs.

Need-based financial aid is offered to U.S. citizens and permanent residents from the federal government, some states (including California for residents), private organizations and Harvey Mudd College. HMC uses a national standard known as Institutional Methodology to determine eligibility for scholarship assistance. A limited amount of HMC need-based scholarship is also available to international students. While need for scholarship is determined annually, the maximum annual award for international students will be limited to the amount granted in the first year at HMC. An international student who does not apply for or does not receive aid as a first-year student will not be considered for financial aid in future years at HMC due to the limited and highly competitive nature of our funding.

The Office of Financial Aid is required to coordinate all funds that a student receives to ensure that each student's financial need is met and that a student does not receive more financial aid than he/she qualifies for. For this reason, HMC has established policies on how the receipt of additional funds will affect financial aid eligibility. For example, if a student receives a Federal Pell Grant, a Cal Grant, other state grant, an HMC-sponsored National Merit Scholarship or a Harvey S. Mudd Merit Award, the student's need-based HMC Scholarship award may be reduced by an equal amount. If a student receives a scholarship or grant from a private organization, financial aid eligibility will be adjusted according to a standard formula. All outside scholarship funds are added together and the following is applied: the first \$500 will reduce need-based student loans and/or Federal Work-Study funds. One-half of the remaining amounts will reduce need-based HMC Scholarship and the other half will further reduce need-based student loans and/or Federal Work-Study funds. Once need-based student loans and Federal Work-Study amounts have been completely eliminated, any additional outside scholarships may reduce the need-based HMC Scholarship only. However, in an effort to maximize financial aid eligibility, students may retain need-based loan and Federal Work-Study amounts up to their federal eligibility.

In an effort to improve our awards, beginning in the fall of 2008, incoming first-year students are eligible to reduce need-based student loans and/or Federal Work-Study funds with outside scholarship funds dollar for dollar. Once need-based student loans and Federal Work-Study amounts have been completely eliminated, any additional outside scholarships will reduce need-based Harvey Mudd Scholarships only. Rising fourth-year students are not eligible under this new policy.

The financial aid process at HMC adheres to strict deadlines. Students must apply for financial aid by our published deadlines and submit all supporting documents in a timely manner. Failure to meet our published deadlines may jeopardize financial aid eligibility, as funds are awarded on a first come, first served basis. A student who receives financial aid and withdraws from HMC during the semester will have his/her financial aid adjusted according to the actual period of enrollment and the terms of the aid program.

A student who becomes delinquent on student loan payments after he/she graduates

or leaves HMC may have academic transcripts withheld until payments are made current. Appeals to financial aid decisions should be addressed to the Office of Financial Aid.

Unresolved appeals may then be taken to the director of financial aid, the vice president and dean of admission and financial aid, and, finally, to the president of the College.

DELINQUENT ACCOUNTS

Every student is responsible for meeting promptly any payment due the college. Satisfactory arrangements for payment of the total charges on a student account for each semester, less financial aid, must be made prior to the beginning of each semester per the Tuition Payment Agreement.

A student account not meeting the requirements set forth in the Tuition Payment Agreement is considered delinquent. A student whose account is delinquent is subject to a late fee charge of one percent (1%) of the delinquent amount. A student with a delinquent account may be assessed a late-registration penalty and may also be disenrolled, resulting in prohibition from class attendance, revocation of dining hall privileges and/or ineligibility to pre-register for the subsequent semester. Any student leaving HMC with an unpaid financial obligation will not be issued an official transcript of grades until settlement is made.





FACULTY

Stephen C. Adolph, *Professor of Biology and Chair, Department of Biology, 1993*. B.S., M.S., Stanford University; Ph.D., University of Washington. Lecturer, University of Texas, Austin; Visiting Assistant Professor, Middlebury College; Postdoctoral Research Associate, University of Wisconsin, Madison.

Anna N. Ahn, *Barbara Stokes Dewey Assistant Professor of Biology, 2005*. B.A., Ph.D., University of California, Berkeley. Visiting Scientist, Massachusetts Institute of Technology; Postdoctoral Research Fellow, Harvard University.

Christine Alvarado, *Assistant Professor of Computer Science, 2005*. A.B., Dartmouth College; S.M., Ph.D., Massachusetts Institute of Technology. Instructor, University of California, San Diego; Instructor, Massachusetts Institute of Technology.

William Alves, *Professor of Music, 1995*. B.M., B.S., Trinity University; M.M., D.M.A., University of Southern California. Lecturer, University of Southern California; Lecturer, Scripps College; Fulbright Senior Scholar, Institut Seni Indonesia, Yogyakarta.

David Asai, *Professor of Biology, 2003*. (On leave 2010-2011) B.S., M.S., Stanford University, Ph.D., California Institute of Technology. Assistant, Associate and Full Professor, Associate Department Head, Department Head, Purdue University; Chair, Department of Biology, Harvey Mudd College.

Shenda M. Baker, *Professor of Chemistry, 1992*. B.A., Grinnell College; Ph.D., California Institute of Technology. Post-doctoral Fellow, Los Alamos National Laboratories.

Isabel Balseiro, *Alexander and Adelaide Hixon Professor of Humanities, 1993*. B.A., Barnard College, Columbia University; Ph.D., New York University. Visitor with Associate Status, African Studies Centre, University of Cambridge; Lecturer, Rutgers University.

Hal S. Barron, *Louisa and Robert Miller Professor of Humanities, 1979*. A.B., Oberlin College; M.A., Ph.D., University of Pennsylvania. Postgraduate Research Historian, University of California, Riverside; Visiting Associate Professor, Waseda University, Tokyo, Japan; Vernon Carstensen Award; Graves Award; NEH Summer Fellow (twice); Haynes Fellow; Newberry Library NEH Fellow; Huntington Library-Haynes Fellow; NEH Senior Fellow.

Lori C. Bassman, *Associate Professor of Engineering and Associate Chair, Department of Engineering, 2000*. B.S.E., Princeton University; M.S., Ph.D., Stanford University. Associate Lecturer, University of Southern Queensland, Toowoomba, Australia; Research Assistant, Center for Integrated Systems, Stanford University; Teaching Assistant, Stanford University.

Carl J. Baumgaertner, *Clinical Professor of Engineering, 1987*. B.S., St. Thomas College. Postgraduate studies at University of Minnesota. Staff member, 3M Company; Chief Engineer, Manager, Director of Engineering, Honeywell, Inc.

Arthur T. Benjamin, *Professor of Mathematics, 1989*. B.S., Carnegie Mellon University; M.S., Ph.D., The Johns Hopkins University. Staff Member, National Security Agency, Washington, D.C.; Visiting Professor, California Institute of Technology.

Andrew J. Bernoff, *Kenneth A. and Diana G. Jonsson Professor of Mathematics and Chair, Department of Mathematics, 1998*. B.S. Applied Math, B.S. Physics, Massachusetts Institute of Technology; Ph.D. Trinity College, Cambridge. Member, Mathematical Sciences Research Institute, University of California, Berkeley; N.S.F. Postdoctoral Fellow, University of California, Berkeley; Assistant Professor, Northwestern University; Visiting Faculty, Duke University; Visiting Scientist, University of British Columbia.

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Eliot Bush, *Assistant Professor of Biology, 2007*. B.S., Harvard University; Ph.D., California Institute of Technology. Postdoctoral Fellow, the University of Chicago.

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Alfonso Castro, *Professor of Mathematics, 2003*. B.S., M.S., Universidad Nacional de Colombia; Ph.D., University of Cincinnati. Chair, Department of Applied Mathematics, Professor of and Director of the Division of Mathematics, University of Texas, San Antonio; Associate and Full Professor, University of North Texas; Program Director: Applied Mathematics and Classical Analysis, National Science Foundation; Associate Professor, Southwest Texas State University; Visiting Professor, Universidad de Brasília; Associate and Full Professor, Associate Chairman, Mathematics, Centro de Investigación del I.P.N., Mexico.

Robert J. Cave, *Professor of Chemistry and Vice President and Dean of Faculty, 1988*. B.S., Michigan State University; Ph.D., California Institute of Technology. National Science Foundation Predoctoral Fellow; Postdoctoral Fellow, Indiana University; Camille and Henry Dreyfus Teacher-Scholar; Research Associate, Brookhaven National Laboratory; Visiting Professor, Rutgers University; Associate Dean for Academic Affairs, Harvey Mudd College; Director of Study Abroad, Harvey Mudd College.

Philip D. Cha, *Professor of Engineering, 1991*. B.S., Cornell University; M.S., Ph.D., University of Michigan. Senior Research Engineer, Ford Motor Company. Visiting Professor, University of Michigan; Participating Guest, Lawrence Livermore National Laboratory.

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David Cubek, *Assistant Professor of Music and Director of the Claremont Concert Orchestra, Scripps College (Joint Music Program), 2010*. D.M.A. Northwestern University.

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Marianne de Laet, *Associate Professor of Anthropology and Science, Technology and Society, 2001*. B.A., M.A., University of Leiden; Ph.D., University of Utrecht. Senior Research Fellow and Lecturer, California Institute of Technology; NWO postdoctoral fellow at Columbia University; Bamberger and Fuld Fellow, Institute for Advanced Study at Princeton; Fulbright Scholar, University of California, Santa Cruz.

Lisette de Pillis, *Norman F. Sprague, Jr. Professor of Mathematics and the Life Sciences and Director, Global Clinic, 1993*. B.A., University of California, San Diego; M.A., Ph.D., University of California, Los Angeles. Research Assistant, Chr. Michelsen Institute, Norway; Jet Propulsion Laboratory; Los Alamos National Laboratory.

Zachary Dodds, *Professor of Computer Science, 1999*. B.A., M.S., Ph.D., Yale University. Research Fellow, Yale Center for Computational Vision and Control; Software Manager, HelpMate Robotics.

Thomas D. Donnelly, *Professor of Physics and Associate Dean for Faculty Development, 1997*. B.A. Middlebury College; Ph.D. University of California, Berkeley. Visiting Assistant Professor, Swarthmore College.

Robert Drewell, *Associate Professor of Biology, 2006*. B.Sc., King's College, London; Ph.D., University of Cambridge. Assistant Professor, University of Nevada, Reno; Postdoctoral Fellow, California Institute of Technology; Postdoctoral Fellow, University of California, Berkeley.

Ziyad H. Durón '81, *Jude and Eileen Laspa Professor of Engineering and Chair, Department of Engineering, 1987*. B.S., Harvey Mudd College; M.S., Massachusetts Institute of Technology; Ph.D., California Institute of Technology. Engineer, Arco Oil and Gas Company, NASA Dryden Flight Research Center; Member of the Technical Staff, The Aerospace Corporation; Visiting Research Associate, California Institute of Technology.

Clive L. Dym, *Fletcher Jones Professor of Engineering Design, 1991*. B.C.E., Cooper Union; M.S., Polytechnic Institute of Brooklyn; Ph.D., Stanford University. Assistant Professor, State University of New York, Buffalo; Research Staff Member, Institute for Defense Analysis; Associate Professor, Carnegie Mellon University; Senior Scientist, Bolt, Beranek and Newman; Professor and Head, Department of Civil Engineering, University of Massachusetts; Visiting Associate Professor, Technion-Israel Institute of Technology; NATO Fellow, University of Southampton (England); Visiting Scientist, Xerox Palo Alto Research Center; Visiting Professor, Stanford University, Carnegie-Mellon University; Fellow: Acoustical Society of America, American Society of Civil Engineers, American Society of Mechanical Engineers.

Erika W. Dyson, *Assistant Professor of Religious Studies, 2009*. B.A., Mount Holyoke College; M.A., Columbia University, M. Phil, Columbia University; Ph.D., Columbia University.

James C. Eckert, *Professor of Physics, 1980*. B.S., M.A., Ph.D., University of Southern California. Instructor, Loyola Marymount University; Visiting Associate Professor, University of Minnesota.

Adam J. Edwards, *Assistant Professor of Physics, 2008*. B.S., University of California, Berkeley; M.S., Ph.D., Stanford University. Instructor, Pomona College.

Michael A. Erlinger, *Professor of Computer Science and Chair, Computer Science Department, 1981*. B.S., University of San Francisco; M.S., Ph.D., University of California, Los Angeles. Lecturer, University of California, Los Angeles; Technical Staff Member, Bell Telephone Laboratory; Senior Project Engineer, Hughes Aircraft Company; Member of the Technical Staff, The Aerospace Corporation.

Ann Esin, *Associate Professor of Physics, 2002*. B.S., Massachusetts Institute of Technology; A.M., Ph.D., Harvard University. Postdoctoral Fellow, Theoretical Astrophysics, California Institute of Technology; Visiting Assistant Professor, Harvey Mudd College.

Gary R. Evans, *Ruth and Harvey Berry Professor of Entrepreneurial Leadership and Director, Entrepreneurial Network, 1981*. B.A., California State University, Fresno; M.S., Ph.D., University of California, Riverside. Lecturer, University of California, Riverside.

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Weiqing Gu, *Professor of Mathematics, 1996*. B.S., Shanghai Teachers University; M.S., Ph.D., University of Pennsylvania.

David Money Harris, *Professor of Engineering and Associate Director, Engineering Clinic, 1998*. S.B. and M. Eng., Massachusetts Institute of Technology; Ph.D., Stanford. Technical Staff Member, Sun Microsystems and Intel Corporation.

Sarah L. Harris, *Associate Professor of Engineering, 2005*. B.S., Brigham Young University; M.S., Ph.D., Stanford University. Visiting Assistant Professor, Harvey Mudd College; Science Writer, WOSU Public Radio; Instructor, Research Assistant, Stanford University.

Richard C. Haskell, *Burton G. Bettingen Professor of Physics and Director, Physics Clinic, 1980*. B.S., Lehigh University; Ph.D., The Johns Hopkins University. NIH Postdoctoral Fellow, Muscular Dystrophy Postdoctoral Fellow, Associate Research Scientist, The Johns Hopkins University.

Karl A. Haushalter, *Associate Professor of Chemistry and Biology, 2003*. B.A., Rice University; Ph.D., Harvard University. Postdoctoral Fellow, University of California, San Diego; Visiting Lecturer, University of California, Irvine.

Adrian Hightower, *Assistant Professor of Engineering, 2010*. B.S., M.S. Ph.D., California Institute of Technology. Assistant Professor, Occidental College.

Jon Jacobsen, *Associate Professor of Mathematics and Associate Dean for Academic Affairs, 2002*. B.S., M.S., California Polytechnic State University, San Luis Obispo; Ph.D. University of Utah. S. Chowla Research Assistant Professor, The Pennsylvania State University, Visiting Scholar in the Faculty of Science, University of Alberta.

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Geoffrey Kuennig, *Professor of Computer Science, 1998*. B.S., M.S., Michigan State University; Ph.D., University of California, Los Angeles. Computer Scientist, Lawrence Livermore Laboratory; Systems Programmer, Ball Computer Products; Senior Software Engineer, Digital Equipment Corporation; Manager of Operating Systems Development, Callan Data Systems; Principal Consultant, Interrupt Technology Corporation; Visiting Lecturer, University of California, Los Angeles.

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Debra Mashek, *Iris and Howard Critchell Assistant Professor of Psychology, 2005*. B.S., Nebraska Wesleyan University; M.A., Ph.D. State University of New York at Stony Brook. Research Assistant Professor, George Mason University; Postdoctoral Research Fellow, George Mason University.

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Nicholas Pippenger, *Professor of Mathematics, 2006*. B.S., Shimer College; B.S., M.S., Ph.D., Massachusetts Institute of Technology. Professor of Computer Science, Princeton University; Professor of Computer Science, University of British Columbia; MIT Instrumentation Laboratory (now the Charles Stark Draper Laboratory); IBM Research; University of British Columbia; IBM Fellow, Almaden IBM Research Center.

Jules B. Prag IV, *Visiting Associate Professor, (2004-2011)*. B.B.A., M.A., University of Florida; M.A., Ph.D., University of Rochester. Assistant Professor, Claremont McKenna College, Visiting Associate Professor, Pomona College, Visiting Associate Professor, Claremont Graduate University.

Donald S. Remer, *Oliver C. Field Professor of Engineering Economics, 1975*. B.S., University of Michigan; M.S., Ph.D., California Institute of Technology. Engineering Economic and Planning Analyst, Senior Project and Process Engineer, Task Force Manager, Exxon Chemical Company; Case Study Editor, *The Engineering Economist*; Member of the Technical Staff, Manager of Planning Analysis, Jet Propulsion Laboratory; Registered Professional Engineer, California.

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R. Erik Spjut, *Professor of Engineering and Director, Engineering Clinic, 1988*. B.S., University of Utah; Ph.D., Massachusetts Institute of Technology. Assistant Professor, Massachusetts Institute of Technology.

Paul F. Steinberg, *Associate Professor of Political Science and Environmental Policy, and Director, Center for Environmental Studies, 2003*. B.A., University of California, Santa Barbara; M.P.A., Harvard University, John F. Kennedy School of Government; Ph.D., University of California, Santa Cruz. Visiting Scholar, Paul H. Nitze School of Advanced International Studies, Johns Hopkins University; Visiting Assistant Professor, Duke University; Founding Director, Conservation Policy and Governance Program, RARE Center for Tropical Conservation; policy advisor to The World Bank, Conservation International, World Conservation Union and Natural Resources Defense Council.

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John S. Townsend, *Susan and Bruce Worster Professor of Physics and Chair, Department of Physics, 1975*. B.S., Duke University; M.A., Ph.D., The Johns Hopkins University. National Science Foundation Graduate Fellow, Associate Research Scientist and Lecturer, The Johns Hopkins University; Research Associate, Stanford Linear Accelerator Center, Stanford University; Visiting Associate, California Institute of Technology; Visiting Fellow, University of Southampton, England; Science Fellow, Center for International Security and Arms Control, Stanford University; Visiting Professor, Duke University.

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Darryl H. Yong '96, *Associate Professor of Mathematics and Associate Chair, Department of Mathematics, 2003*. B.S., Harvey Mudd College; M.S., The Claremont Graduate School; Ph.D., University of Washington. Von Kármán Instructor, California Institute of Technology; Visiting Assistant Professor, Harvey Mudd College.

JOINT ATHLETICS FACULTY

Harvey Mudd College has cooperated with Claremont McKenna and Scripps Colleges since 1956 to provide students with state-of-the-art athletic facilities and coaches with expertise in 21 (10 men's, 11 women's) varsity sports. This joint program is known as CMS athletics (Claremont-Mudd-Scripps), and its primary purpose is to enhance student development and personal growth through participation in intercollegiate athletics. The entire CMS faculty is listed below, though only one-third of them are officially assigned to HMC at any time.

Michael Sutton, *Professor of Physical Education and Athletic Director, 1979*. B.A., Claremont McKenna College; M.S., United States Sports Academy. Head Men's Water Polo Coach, Head Men's and Women's Swim Coach, Claremont-Mudd-Scripps Colleges 1979–2000; Team Leader, United States Water Polo Men's Olympic and National Team, 1988–1992.

Jodie Rae Burton, *Professor of Physical Education and Head Women's Basketball and Golf Coach, Senior Woman Administrator and Associate Athletic Director, 1979*. B.S., M.S., California State Polytechnic University, Pomona. Teacher-Coach, Polytechnic School, Pasadena.

Dan Calichman, *Assistant Professor of Physical Education and Head Men's Soccer Coach, 2002*. B.A., Williams College. Head Coach, American Global Soccer School; Major League Soccer (player L.A. Galaxy, San Jose Earthquakes, New England Revolution).

John Goldhammer, *Professor of Physical Education and Head Men's and Women's Cross Country Coach and Associate Athletic Director, 1984*. B.A., University of California, Santa Barbara. M.A., California State University, Los Angeles; Instructor and Track and Field Coach, Santa Barbara City College; Assistant Women's Track Coach and Men's Field Event Coach, University of California, Santa Barbara.

Dianna Graves, *Associate Professor of Physical Education and Head Women's Volleyball Coach, 2001*. B.A., Claremont McKenna College; M.A., Claremont Graduate University. Research Associate, City of Hope; teacher, Ontario-Montclair School District.

Charles Griffiths, *Associate Professor of Physical Education and Head Men's and Women's Swimming Coach, 2001*. B.A., Denison University. Assistant Men's and Women's Swim Coach, Denison University.

Betsy Hipple, *Assistant Professor of Physical Education and Head Women's Softball Coach, 2005*. B.S., Northeastern University; M.S., University of Utah. Head Softball Coach, Hunter College (City University of New York).

Greg Lonzo, *Assistant Professor of Physical Education and Head Men's and Women's Water Polo Coach, 2001*. Pepperdine, 2002, three time NCAA Water Polo All-American. CMS Interim head coach, 2007-08. CMS Assistant coach 2004-05. Head coach Riverside Water Polo Club, 2002-2007.

Ginger Miles, *Head Women's Lacrosse Coach and Instructor of Physical Education, 2009*. B.A., University of Virginia. Volunteer Assistant Coach and Admissions Counselor, Office of Undergraduate Admissions, University of Virginia; Coach, Blue Ridge Lacrosse Club; Coach, Virginia Western Region squad, 2008 Commonwealth Games; Assistant Coach, Western Albemarle High School, Virginia.

JOINT ATHLETICS FACULTY, continued

Maxanne Retzlaff, *Associate Professor of Physical Education and Head Women's Tennis Coach, 1992.* B.S., St. John's University; M.S., Manhattan College.

Steven Retzlaff, *Assistant Professor of Physical Education and Interim Head Football Coach, 1993.* B.S., University of California, Santa Barbara; M.S. candidate, S.W. Post, Long Island University. Assistant Football Coach, Hofstra University.

Keri Sanchez, *Assistant Professor of Physical Education and Head Women's Soccer Coach, 2003.* B.A., University of North Carolina, Chapel Hill; M.A., University of Oregon. WUSA player and Assistant Coach, University of Oregon.

Kenneth Scalmanini, *Assistant Professor of Physical Education and Head Men's Basketball Coach, 1999.* A.A., Santa Rosa Junior College; B.S., California State Polytechnic University, Pomona; M.S. candidate, Azusa Pacific University. Assistant Men's Basketball Coach, Claremont-Mudd-Scripps Colleges.

Paul Settles, *Assistant Professor of Physical Education and Head Men's Tennis Coach, 2004.* B.A., University of Pennsylvania, M.A. Phil, Cambridge University. Director of Player Services, ATP, Ponte Vedra, FL.

Randall Town, *Associate Professor of Physical Education and Head Men's Baseball Coach and Director of Physical Education, 1987.* A.A., West Hills Junior College; B.A., M.A., California State University, Stanislaus. Instructor of Physical Education and Assistant Baseball Coach, California State University, Stanislaus.

HMC EMERITI

- Tad A. Beckman**, *Professor of Philosophy Emeritus, 1961.*
- Robert L. Borrelli**, *Professor of Mathematics Emeritus, 1964.*
- Courtney S. Coleman**, *Professor of Mathematics Emeritus, 1959.*
- Iris C. Critchell**, *Instructor of Aeronautics Emerita, 1962.*
- Nathaniel Davis**, *Professor of Humanities Emeritus, 1983.*
- Deren Finks**, *Dean of Admission Emeritus, 1988.*
- Mack Gilkeson**, *Professor of Engineering Emeritus, 1961.*
- Daniel L. Goroff**, *Professor of Mathematics and Economics, Vice President and Dean of the Faculty Emeritus, 2005.*
- John Greever**, *Professor of Mathematics Emeritus, 1961.*
- Thomas M. Helliwell**, *Professor of Physics and Dean Emeritus, 1962.*
- Robert T. Ives**, *Associate Professor of Mathematics Emeritus, 1958.*
- Henry A. Krieger**, *Professor of Mathematics Emeritus, 1968.*
- Mitsuru Kubota**, *Professor of Chemistry Emeritus, 1959.*
- Betty Lumpkin**, *Registrar Emerita, 1961.*
- James E. Monson**, *Professor of Engineering Emeritus, 1961.*
- Philip C. Myhre**, *Professor of Chemistry Emeritus, 1960.*
- Daniel C. Petersen**, *Professor of Physics Emeritus, 1974.*
- J. Richard Phillips**, *Professor of Engineering Emeritus, 1966.*
- Alden F. Pixley**, *Professor of Mathematics Emeritus, 1962.*
- Joseph B. Platt**, *Senior Professor of Physics and Founding President Emeritus, 1956.*
- William K. Purves**, *Professor of Biology Emeritus, 1977.*
- David S. Sanders**, *Professor of Literature Emeritus, 1959.*
- William H. Sandmann**, *Professor of Physics Emeritus, 1963.*
- J'nan Morse Sellery**, *Professor of Literature Emerita, 1970.*
- Sedat Serdengecti**, *Professor of Engineering Emeritus, 1961.*
- Wing Cheung Tam**, *Professor of Engineering and Computer Science Emeritus, 1974.*
- B. Samuel Tanenbaum**, *Professor of Life Sciences and Engineering and Dean Emeritus, 1975.*
- Jack H. Waggoner Jr.**, *Associate Professor of Physics Emeritus, 1961.*
- F. Sheldon Wettack**, *Professor of Chemistry and Dean Emeritus, 1993.*
- Harry E. Williams**, *Professor of Engineering Emeritus, 1960.*
- Robert P. Wolf**, *Professor of Physics Emeritus, 1963.*

SENIOR ADMINISTRATION

PRESIDENT OF THE COLLEGE

Maria M. Klawe, *President, 2006*. B.Sc. and Ph.D., University of Alberta, Canada. Academic positions at University of British Columbia, University of Toronto and Oakland University. Research Scientist and Manager, IBM Almaden Research Center, California; Computer Science Department Head, Vice President of Student and Academic Services, and Dean of Science, University of British Columbia; Dean of Engineering and Professor of Computer Science, Princeton University.

PRESIDENT'S CABINET

Karen Angemi, *Director of the President's Office and Secretary to the Board, 2003*.

Vacant, *Vice President for College Advancement*.

Thyra L. Briggs, *Vice President for Admission and Financial Aid, 2007*. B.A., Connecticut College. Dean of Enrollment, Sarah Lawrence College; Dean of Admission, Associate Director of Admission, Assistant Director of Admission, Admission Counselor, Sarah Lawrence College.

Marguerite A. Browning, *Vice President and Dean of Students, 2009*. B.A., University of Massachusetts, Boston; Ph.D., Massachusetts Institute of Technology. Associate Professor Emeritus, Council of the Humanities and Program in Linguistics, Princeton University. Master of Wilson College, Princeton University. Director of the Program in Linguistics, Princeton University.

Robert J. Cave, *Vice President for Academic Affairs and Dean of Faculty and Professor of Chemistry, 1988*. B.S., Michigan State University; Ph.D., California Institute of Technology. National Science Foundation Predoctoral Fellow; Postdoctoral Fellow, Indiana University; Camille and Henry Dreyfus Teacher-Scholar; Research Associate, Brookhaven National Laboratory; Visiting Professor, Rutgers University; Associate Dean for Academic Affairs, Harvey Mudd College; Director of Study Abroad, Harvey Mudd College.

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Joseph Vaughan, *Chief Information Officer and Vice President of Computing and Information Services, 2008*. B.A., Trinity College, Dublin; C. Phil, M.A., University of California, Los Angeles. Director/Humanities CIO, UCLA Center for Digital Humanities; Chief Administrative Officer, Dodd Humanities Group, UCLA; Co-founder and Head of Studies, Piccadilly Idiomas, Madrid, Spain.





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ACADEMIC CALENDAR 2010–2011

FALL 2010 FIRST SEMESTER (70 DAYS + 5 DAYS FINALS)

August 26	Thurs	Residence halls open for new students; orientation begins
August 29	Sun	Residence halls open for returning students; first meal - dinner
August 30	Mon	Administrative offices open
August 31	Tues	First semester classes begin at 8:10 a.m.
September 2	Thurs	Convocation 4:15 p.m.
September 6	Mon	Labor Day - offices closed, classes held
September 13	Mon	Last day to add full semester and first half semester courses
October 1	Fri	Last day to drop first half semester courses Last day to declare first half semester courses Pass/Fail
October 15	Fri	Fall break begins after last class; first half semester courses end
October 20	Wed	Fall break ends 8:00 a.m. Second half semester classes begin
November 5	Fri	Last day to add second half semester courses
November 15-18	Mon-Thurs	Pre-registration for Spring 2011 (with Web registration)
November 19	Fri	Last day to drop full semester and second half semester courses Last day to declare full semester and second half semester courses Pass/Fail
November 24	Wed	Thanksgiving recess begins after last class
November 29	Mon	Thanksgiving recess ends 8:00 a.m.
December 10	Fri	Last day of first semester classes
December 13	Mon	Final examinations begin
December 17	Fri	Final examinations end; last meal - lunch
December 18	Sat	Residence halls close 8:00 a.m.
December 23	Thurs	Grades due to registrar by 4:59 p.m.
January 3	Mon	Fall grades viewable on the portal

SPRING 2011 SECOND SEMESTER (71 DAYS + 5 DAYS FINALS)

January 16	Sun	Residence halls open 8:00 a.m. for all students
January 17	Mon	Martin Luther King Day, offices closed; first meal - brunch
January 18	Tues	Administrative Offices open Second semester classes begin 8:10 a.m.
January 31	Mon	Last day to add full semester and first half semester courses
February 18	Fri	Last day to drop first half semester courses Last day to declare first half semester courses Pass/Fail
March 4	Fri	First half semester classes end
March 7	Mon	Second half semester classes begin
March 11	Fri	Spring vacation begins after last class
March 21	Mon	Spring vacation ends 8:00 a.m.
March 25	Fri	César Chávez Day, offices closed; no HMC classes
March 28	Mon	Last day to add second half semester courses
April 15	Fri	Last day to drop full semester and second half semester courses Last day to declare full semester and second half semester courses Pass/Fail
April 19-21	Tues-Thurs	Pre-registration for Fall 2011 (dates subject to change)
May 2-4	Mon-Wed	Student presentations; no HMC classes
May 4	Wed	Last day of HMC second semester courses (CMC, PO, SC—same; PZ—May 6)
May 5-6	Thurs-Fri	Finals for seniors; reading days for other students
May 9	Mon	Senior grades due to registrar by 9:00 a.m.; other final examinations begin
May 13	Fri	Final examinations end
May 15	Sun	Commencement at 1:30 p.m.; last meal, brunch
May 16	Mon	Residence halls close 8:00 a.m.
May 19	Thurs	All other grades due to registrar by noon
May 24	Tues	Spring grades viewable on the portal

2011–12

August 30, 2011	Tues	Fall 2011 semester begins
May 13, 2012	Sun	Commencement