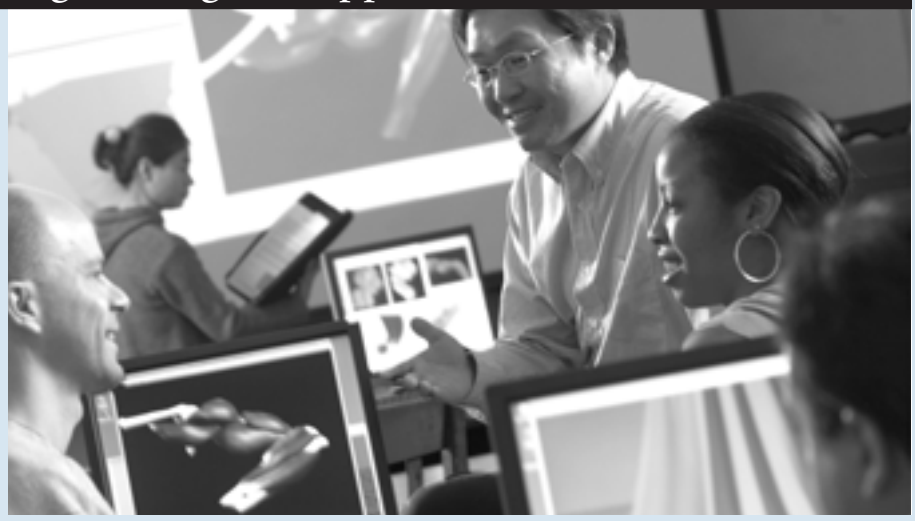
At A Glance: College of Engineering and Applied Science



Students*

829
Undergraduate: 510
Graduate: 319

Degrees Awarded 2006‡

258
Undergraduate: 132
Graduate: 126

Faculty*

Full-time: 37
Lecturers: 48

Student-Faculty Ratio*

9:1

Undergraduate Degree Program Offering 10 Areas of Emphasis

Civil Engineering
Computer Science and Engineering
Electrical Engineering
Mechanical Engineering

Graduate Degree Programs

Civil Engineering, MS, PhD
Computer Science, MS
Computer Science and Information Systems, PhD
Electrical Engineering, MS
Engineering, MEng
Mechanical Engineering, MS

Other Programs

BS in engineering and business administration
Premedicine (bioengineering) option
BS and MS degree program
Computational biology option

Research Centers

Center for Geotechnical Engineering Science
Facility for Advanced Spatial Technology
Transportation Research Center

Accreditation

Accreditation Board for Engineering and Technology (ABET)

Student Organizations

American Society of Civil Engineers
American Society of Mechanical Engineers
Association for Computing Machinery
Chi Epsilon, honorary civil engineering society (invitation only)
Eta Kappa Nu, honorary electrical engineering society (invitation only)
Institute of Electrical and Electronic Engineers
Participatory Learning and Creativity Education for Sustainability
Pi Tau Sigma, honorary mechanical engineering society (invitation only)
Student Advisory Panel
Society of Hispanic Professional Engineers
Society of Women Engineers
Tau Beta Pi, honorary engineering society (invitation only)

Alumni‡

6,023
Undergraduate: 73%
Graduate: 27%
Strong alumni network for job placement.

Average starting salary for those working full-time in related field†:

Graduate Engineering Students = $73,333
Undergraduate Engineering Students = $55,000

Engineering Leadership Council

James D. Bartlett, Jr., Sopheon
Paul E. Bartlett, Dean Emeritus
Francis Lee Belisle, Raytheon Company
David Bennetts, Urban Drainage & Flood Control District
Stanley R. Bull, National Renewable Energy Laboratory
Ralph W. Christie, Jr., Merrick & Company
Robert L. Clevenger, DMJM Harris
Grady Cope, Reata Engineering and Machine Works
Lesley S. Craig
Carlos de Moraes
Michael J. Driver, Patton Boggs, LLP
Marcia Edwards, Lockheed Martin
Mary J. Gearhart, Brown and Caldwell
Mark Glidden, CH2M HILL
Richard Hepworth, Hepworth-Pawlak Geotechnical, Inc.
Tai-Dan Hsu, Pacific Western Technologies, Ltd.
Albert Knott, Albert Knott & Associates
Kathryn L. Lee, Raytheon Company
Tom Maceyka, Sundyne Corporation
Gary Meggison, The Weitz Company
Gabriele Miles
J.J. O'Brien, Washington Group International, Inc.
Keith Platte, R.W. Beck, Inc.
Pedro C. Repetto, URS Corporation
Arthur C. "Sandy" Riese, EnSci, Inc.
George Saliba, Quantum
Kristy Schloss, Schloss Engineered Equipment, Inc.
Barbara Schroeder, Parsons Transportation Group, Inc.
Narayan Shrestha, SANN Research Institute
Anne Stilson-Cope, Corey Electrical Engineering, Inc.
Doug Tashiro
George L. Thorn, Mile High Development, LLC
Donald G. White

*Fall 2006 end-of-term enrollment data ‡Fiscal year 2005-2006 data †2005 survey of 2003-2004 graduates, one year after graduation

College of Engineering and Applied Science

Dean
Renjeng Su

Associate Dean
John Trapp

Contact

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North Classroom 3024
1200 Larimer Street, 3rd Floor
303-556-2870
Fax: 303-556-2511
www.cudenver.edu/engineer

Mailing Address
College of Engineering and Applied Science
Campus Box 104
P.O. Box 173364
Denver, CO 80217-3364

Engineering Student Services/ Academic Advising
303-556-4768

Application Deadlines

Undergraduate
Fall—August 1
Spring—December 1
Summer—May 1

Graduate Programs

Civil Engineering
Rolling Admissions

Computer Science and Engineering
Fall—March 15
Spring—October 1
Summer—January 15

Electrical Engineering
Rolling Admissions

Mechanical Engineering
Fall—April 1
Spring—October 1

Continuing an 80-year tradition, the College of Engineering and Applied Science on the downtown Denver campus of the University of Colorado at Denver and Health Sciences Center (UCDHSC)meets the needs of the Denver metropolitan area by providing nationally accredited engineering education in a flexible format that suits both students and employers. UCDHSC is the only institution in the area where the working individual can earn both undergraduate and graduate degrees in engineering entirely through evening studies. Recognizing the importance for students to pursue professional studies and related employment simultaneously, the college offers undergraduate and graduate degree programs in civil engineering, mechanical engineering, electrical engineering, and computer science and engineering through evening studies or through a more traditional schedule of day classes. As a practicing engineer, you can improve and update your professional capabilities and earn a graduate degree. Or, through our interdisciplinary master of engineering degree, you can obtain graduate education in management, computer science, behavioral science or other areas together with new engineering skills in your field. We also participate in an interdisciplinary master of science in environmental science.

A listing of the fields in which engineers work would have hundreds of entries. The following list gives only a brief summary of the fields available at UCDHSC.

Civil engineering offers an interesting and challenging career in the design and construction of buildings, bridges, dams, aqueducts and other structures; in transportation systems including highways, canals, pipelines, airports, rapid transit lines, railroads and harbor facilities; in the distribution of water and the regulation of rivers; in the development of water resources for urban use, industry and land reclamation; in the control of water quality through water purification and proper waste treatment; in the construction and contracting industry; and in the problems concerned with our physical environment and the growth of cities.

Computer science and engineering involves work in the theory, design and application of computers and computational methods. It includes design and development of efficient software systems, as well as hardware design and manufacture. The application of microprocessors to many areas of engineering has opened new opportunities in computer engineering and computer science.

Electrical engineering offers professional careers that include research in development of new electrical or electronic devices, instruments or products; design of equipment or systems; production and quality control of electrical products; and sales or management for private industry or government. There are numerous specialties within electrical engineering. Among them are the design and application of computer systems and digital engineering; electromagnetic fields and microwave devices; control systems; communication theory and signal processing; electrical integrated circuits and electron devices; and energy and power systems.

Mechanical engineering offers a wide range of interesting and challenging career opportunities in research, design, development, manufacturing, testing and marketing for either private industry or government.

Mechanical engineers help develop a wide range of products such as engines, transmissions, compressors, pumps, computer disk drives, oil field drilling rigs, missiles, space satellites, earth-moving equipment, container-manufacturing machines, medical equipment and many other products encountered in daily life.

College of Engineering and Applied Science Educational Goals

The College of Engineering and Applied Science has established the following goals and objectives for undergraduate education:

- successful completion of the fundamental core courses, primarily lower division, in mathematics and the physical sciences
- successful completion of the required upper-division courses in engineering science, analysis and design
- successful completion of real-world engineering design projects that require integration of engineering, economic and social skills
- successful completion of a series of humanities and social science courses that introduce the student to societal problems and historical perspectives
- evidence, through close student/faculty contact, of development of professionalism, ethics and concern for the multifaceted human element of engineering
- evidence, from successful completion of a full engineering curriculum, of the ability to maintain professional competency through lifelong learning
- evidence, through successful completion of a series of communications-oriented courses and project presentations, of an ability to communicate effectively with professionals and lay persons alike

Accreditation

The civil, computer science and engineering, electrical and mechanical engineering programs are accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET).

Availability of Degree Programs

UCDHSC will accept for matriculation only those prospective engineering students who designate a degree program awarded by the UCDHSC College of Engineering and Applied Science. *Students desiring degree programs other than those named above must apply to the campus awarding the degree.* In some cases, the university campus accepting the student may grant permission to take courses on another CU campus, subject to enrollment limitations. In such cases, the engineering department of the admitting campus will counsel the student in the preparation of course schedules.

Nondegree Students

Nondegree students may apply 12 semester hours of course work (or up to 18 if taken in one semester) toward a bachelor's degree in engineering from UCDHSC. Nondegree graduate students may apply 9 semester hours of course work toward a master's degree in engineering from UCDHSC.

Summer Courses

Summer session courses are offered for regular students and those who have academic deficiencies. Courses are also offered for high school graduates who wish to enter as freshmen and need some additional preparatory work.

For some students, there are advantages in starting their college careers during the summer session. Some required freshman and sophomore courses and many elective courses are offered at UCDHSC during the summer. The summer session gives students a head start and enables them to take a lighter load during the fall semester or take additional courses to enrich their programs.

Computing

The College of Engineering and Applied Science encourages all students to develop their skills in using the computer as a tool, not only for solving technical problems but for use in all other facets of their careers. Students are encouraged to explore computer courses other than the fundamental programming course required in their curriculum.

Cooperative Education

Students who need or prefer to work while completing their degrees should explore cooperative education offered through full-time work alternating with semesters of full-time school or work part time year round. Many co-op positions lead to permanent career appointments upon graduation.

This program is available to students who have completed their freshman year and have maintained a GPA of at least 2.5. See the "Career Center" section of the Campus Life chapter in this catalog for further information on this program.

Scholarships, Fellowships and Loan Funds

The college receives an annual allocation of state funds for Dean's Scholarships; these funds are awarded to students who apply and meet scholarship and community service criteria. Additional funds for scholarships and loans are obtained through contributions from alumni and friends. Enrollment in the College of Engineering makes the student eligible for these scholarships. Scholarship application forms are available in the college. Students must apply by March 1 for summer or fall semester or by October 1 for spring semester of each year. All recipients are notified in either May or December. Students can apply for all industry scholarships and Dean's Scholarship using the general application form. Scholarship application forms require information about the applicant's participation in school-related activities, community activities and work. Dean's Scholarship applicants must qualify for in-state tuition and have at least a 3.0 GPA, but do not need to show unmet financial need. All recipients must be registered for six or more hours in the semester when the awards are made.

For more scholarship information go to www.cudenver.edu/engineer under "Student Affairs."

For additional information on other types of financial aid, consult the Tuition, Fees and Financial Aid chapter of this catalog.

Transportation Research Center

Director: Bruce Janson
Telephone: 303-556-2831

The Transportation Research Center (TRC) involves both students and faculty on the downtown Denver campus in a range of education and research activities. The TRC works on projects in collaboration with other departments and colleges such as business, urban planning and public affairs. TRC projects address local, state, national and international concerns with funding from federal, state, local or private sources.

Some focuses of the Transportation Research Center are transportation modeling; traffic monitoring technologies and data analysis techniques; transportation planning and travel demand forecasting for both person and freight movements; traffic engineering and control; facility design and management; use of geographic information systems in transportation; environmental impact assessment; transportation investment decision analysis, including cost-benefit analyses and cross-subsidization issues; and accident studies. Several studies on advanced system development involve partnerships with Colorado's high-tech industry.

Center for Geotechnical Engineering Science

Director: N. Y. Chang
Associate Director: Brian Brady
Telephone: 303-556-2871

The Center for Geotechnical Engineering Science was formed to advance the understanding of the safety, reliability, performance and environmental impact of engineered geostructures. Resolution of geostructural and environmental remediation problems are addressed through research that is sponsored by public funding agencies and private industry, both national and international. The center serves as a vehicle for technology transfer. Cooperative research with other universities in Colorado, the U.S. and around the world is welcomed. The center includes research on geostructural stability, rock engineering, geoenvironmental engineering and expansive soils.

The Expansive Soil Research Laboratory provides leadership in the advancement of technology needed to mitigate damage from expansive soils in Colorado. Studies cover national and international problems, as expansive soils underlie more than one-third of the earth's land surface. In the U.S., these materials are prevalent in the southern, western and Rocky Mountain states. As development takes place in these areas, structures may experience damaging effects of expansive soil resulting in the loss of millions of dollars annually. The current frequency and severity of damage clearly demonstrate that important deficiencies persist in our understanding and application of the current technology in engineering designs.

The Expansive Soil Research Laboratory identifies and conducts research aimed at better understanding of the mechanisms and processes that characterize expansive soil; promotes education and training for engineering students and professionals, the construction industry and the public; assists consulting industries and governments with realistic guidelines on design, construction and operation of facilities built on expansive soils; and provides a database and clearinghouse for information and technology transfer.

Continuing Engineering Education Program

Program Coordinator: Heidi Utt
Telephone: 303-556-4907
Web site: cudenver.edu/engineer/cont

The Continuing Engineering Education Program makes professional development and training opportunities available in engineering and engineering-related fields, such as information technology, civil, mechanical, electrical, project management and systems engineering. The program offers credit and noncredit certificate programs, exam preparation courses, seminars, workshops and short courses.

The program collaborates with key representatives from business, industry, government agencies and professional organizations to provide customized training designed to meet continuing education and professional development goals. Continuing Engineering Education Programs are held at various locations throughout the Denver metropolitan area, including on the Auraria campus.

OTHER UNIVERSITY CAMPUSES

University of Colorado at Boulder

Six engineering departments are located on the campus of the University of Colorado at Boulder. Complete BS, MS and PhD degree programs are offered by the Department of Aerospace Engineering Sciences; the Department of Chemical Engineering; the Department of Civil, Environmental and Architectural Engineering; the Department of Computer Science; the Department of Electrical and Computer Engineering; and the Department of Mechanical Engineering. Undergraduate and graduate degrees also are offered in applied mathematics and engineering physics. The programs at the Boulder campus are primarily oriented to the full-time student who can attend day classes.

University of Colorado at Colorado Springs

Three engineering departments are located on the campus of the University of Colorado at Colorado Springs (UCCS). Complete BS degree programs are offered in electrical engineering, mechanical engineering and computer science, and the MS and PhD degrees are awarded in electrical engineering. The UCCS Department of Mathematics also is a department of the College of Engineering and offers the BS and MS degrees in applied mathematics.

REQUIREMENTS FOR ADMISSION

The student must generally meet the admission requirements described in the Information for Undergraduate Students and Information for Graduate Students chapters of this catalog and of the College of Engineering in which the degree program selected by the student is offered.

Beginning students in engineering should be prepared to start analytic geometry-calculus. No credit toward any degree in engineering will be given for algebra, trigonometry or precalculus mathematics (MATH 1110, 1120 and 1130). (These courses are offered to allow a student to make up deficiencies.) Students who question the adequacy of their precollege background in mathematics should contact the Department of Mathematics office in the College of Liberal Arts and Sciences. Placement tests covering precalculus mathematics are required of new freshmen to select the appropriate beginning mathematics course.

To be prepared for the type of mathematics courses that will be taught, the student must be competent in the basic ideas and skills of ordinary algebra, geometry and plane trigonometry. These include such topics as the fundamental operations with algebraic expressions, exponents and radicals, fractions, simple factoring, solution of linear and quadratic equations, graphical representation, simple systems of equations, complex numbers, the binomial theorem, arithmetic and geometric progressions, logarithms, the trigonometric functions and their use in triangle solving and simple applications, and the standard theorems of geometry, including some solid geometry. It usually takes eight semesters to cover this material adequately in high school.

Refer to the "Minimum Academic Preparation Standards (MAPS)" and "Admission Requirements for Freshmen" sections in the Information for Undergraduate Students chapter of this catalog for a list of high school subjects required for admission to the College of Engineering.

Former Students

Former students must meet the re-admission requirements outlined in the Information for Undergraduate Students and Information for Graduate Students chapters of this catalog.

Students who interrupt their degree program for an extended period will be required to follow the degree program in effect at the time of their re-admission to the college. Repetition of course work may be necessary because of the interruption; re-admitted applicants will be evaluated on an individual basis. Repeated courses must be taken for no credit (*NC*). See the "Repetition of Courses" policy under "Academic Policies" in this chapter of the catalog.

Intercampus Transfer

Transfers between campuses of the University of Colorado should be carefully planned to avoid loss of academic credit. Courses and credits required for engineering degrees vary from campus to campus; therefore, students should plan as far ahead as possible. The campus advisor can help choose the right courses. Such planning should also include contacting the engineering department to which the student plans to

transfer at least one semester before the transfer is planned. The transfer student must have at least a 2.0 GPA for 30 hours of credit toward an engineering degree to be eligible to transfer. A higher GPA may be required to transfer directly into the College of Engineering. In general, calculus, physics and chemistry courses will transfer for full credit. In addition, 12 semester hours of humanities and social sciences electives will usually transfer for full credit. Fundamental computing courses may be unique by campus and should be checked with the campus to which the student is transferring. Any minimum academic preparation standards (MAPS) deficiencies should be eliminated before transferring.

Transfer Agreements

The College of Engineering has formal transfer agreements with the following Denver metro-area community colleges:

Arapahoe Community College (Littleton)—303-794-1550
Community College of Aurora—303-360-4790
Community College of Denver—303-556-2600
Front Range Community College (Westminster)—303-466-8811
Red Rocks Community College (Lakewood)—303-988-6160

These transfer agreements provide an opportunity for potential engineering students to complete courses applicable to an engineering program offered at UCDHSC. Students interested in a transfer should contact Engineering Student Services at 303-556-4768 and the respective community college counseling office at the phone number indicated above.

Transfer Students

Students applying for transfer from other accredited collegiate institutions will be considered for admission on an individual basis, if they meet the requirements outlined in the Information for Undergraduate Students chapter of this catalog and have successfully completed a year each of calculus and physics (calculus-based).

Applications to transfer from another college on the downtown Denver campus to the College of Engineering and Applied Science will be considered on an individual basis by the Office of the Dean, if the student's prior academic record includes successful completion of a year each of calculus and calculus-based physics and the student's cumulative GPA is 2.75 or higher.

Transfer Credit

Refer to the Information for Undergraduate Students and Information for Graduate Students chapters of this catalog for descriptions of university-wide policies on transfer credit.

After a prospective transfer student has made application and submitted official transcripts to the University of Colorado Office of Admissions, that office issues an applicant transfer credit evaluation listing those courses that are acceptable by university standards for transfer. A copy of this evaluation is sent to the student and to the Office of the Dean by the Office of Admissions Processing and is made a part of the permanent record. An advisor will use this form to indicate which courses and credit hours listed are acceptable toward the graduation requirements for the student's degree program. The decisions will be recorded on both the applicant transfer credit evaluation form and the department's study program for BS form, and signed and dated. Both forms are reviewed by the Office of the Dean, and signed and dated. Any modification to the initial evaluation must be by petition, have the recommendation of the transfer advisor and department chair and have approval of the Office of the Dean. All documents will become a part of the student's master file in the Office of the Dean. All transfer credit must be validated by satisfactory achievement in subsequent courses.

Note: All requests for consideration of transfer credit and its application toward a degree in engineering and applied science must be submitted prior to the student's last two semesters at the downtown Denver campus of UCDHSC.

Nontransferable Credits

Courses on basic subjects such as mathematics, physics, literature or history may be acceptable for direct transfer of credit if they were taught as part of an accredited program for all students and were not specifically designated for engineering technology students.

Engineering technology courses (courses with technology designations) will not be considered for transfer into an engineering degree program.

Students may seek credit for course work by examination (see "Transfer of College-Level Credit" section of the Information for Undergraduate Students chapter of this catalog).

UNDERGRADUATE CORE CURRICULUM IN ENGINEERING

The faculty of the College of Arts & Media, the Business School, the College of Engineering and Applied Science, and the College of Liberal Arts and Sciences have established a core curriculum for undergraduate students. See the "General Information" section of this catalog for an overview of the common core concept.

Students graduating from the College of Engineering are required to satisfy the humanities and social sciences and writing portions of their engineering program by taking courses from the UCDHSC core curriculum listed in the engineering table in this chapter.

The intent of the humanities and social sciences component of an engineering program is to provide the student with a coherent and well-structured exploration of a substantive issue or theme appropriate to the engineering profession and/or of interest to the student.

The required humanities and social sciences electives must include both breadth and depth, must include advanced-level course work, and should be planned in consultation with the advisor. A random selection of lower-division courses will not satisfy the humanities and social sciences elective requirement.

Courses such as accounting, contracts, management, elementary foreign languages, public speaking and technical writing are not acceptable as humanities and social sciences electives.

ACADEMIC POLICIES

Refer to the Information for Undergraduate Students and University Policies chapters of this catalog for descriptions of universitywide policies. The following policies apply specifically to students in the College of Engineering and Applied Science.

Advanced Placement

Advanced placement credit may be granted by special examination or by College Entrance Examination Board (CEEB) tests. If the applicant has scored four or five on the CEEB Advanced Placement Examination, credit toward graduation may be awarded. Students who have scored three may be considered for advanced placement by the department concerned. All advanced placement and transfer credit must be validated by satisfactory achievement in subsequent courses in accordance with standard transfer policies of the college.

College-Level Examination (CLEP) Credit

Prospective students may earn college-level credit through the College-Level Examination Program (CLEP) *subject* examinations, provided that they score at the 50th percentile or above. The Engineering Student Services advisor will advise students of the credits accepted for such courses toward a degree program. CLEP *general* examinations are not acceptable. (See also "College-Level Examination Program" in the Information for Undergraduate Students chapter of this catalog.)

Attendance Regulations

Successful work in the College of Engineering and Applied Science is dependent upon regular attendance in all classes. Students who are absent should make arrangements with instructors to make up the work missed. Students who for illness or other good reason miss a final examination must notify the instructor or the Office of the Dean no later than the end of the day on which the examination is given. Failure to do so will result in an *F* in the course.

Changing Departments

Students who wish to change to another department within the College of Engineering and Applied Science must apply for transfer by submitting a change of major for undergraduate degree students form, which must have the approval of the new department. (See also discussion of interdepartmental transfer requirements under "Transfer Students" in this chapter of the catalog.)

Advising

Freshman students are advised by Engineering Student Services and by representatives from each academic department. These representatives are readily available to assist students with academic or vocational concerns. Contact Engineering Student Services at 303-556-4768.

Students are assigned specific departmental advisors for academic planning and should contact the departmental office for advising appointments.

UNDERGRADUATE CORE CURRICULUM IN ENGINEERING

SOCIAL SCIENCES: (3 hours) Choose one course from any of the following courses: ECON, ENVS, ETST, GEOG, HBSC, P SC, SOC.

	Semester Hours
ECON 2012. Principles of Economics-Macro	3
ECON 2022. Principles of Economics-Micro	3
ENVS 1342. Introduction to Environment and Society	3
ETST 2000. Introduction to Ethnic Studies	3
GEOG 1102. World Regional Geography	3
GEOG 1602. Introduction to Urban Studies	3
GEOG 2202. Natural Hazards	3
HBSC 2001. Intro to Community and Population Health Science	3
P SC 1001. Intro to Political Science: Quest for Freedom to Justice	3
P SC 1101. American Political System	3
SOC 1001. Introduction to Sociology	3
SOC 2462. Introduction to Social Psychology	3

HUMANITIES: (3 hours) Choose one course from any of the following courses: ENGL, ETST, FR, GER, HIST, PHIL, RLST.

CNST1000. China and the Chinese	3
ENGL 1601. Telling Tales: Narrative Art in Literature and Film	3
ENGL 2600. Great Works in British and American Literature	3
ETST 2155. African American History	3
FR 1000. Intro to Cultures of the French-Speaking World	3
GER 1000. Germany and the Germans	3
HIST 1361. U.S. History to 1876	3
HIST 1362. U.S. History since 1876	3
HIST 1381. Paths to the Present I	3
HIST 1382. Paths to the Present II	3
PHIL 1012. Intro to Philosophy: Relationship of Individual to World	3
PHIL 1020. Introduction to Ethics & Society: Person and Community	3
PHIL 2441. Logic and Language	3
RLST 1610. Introduction to Religious Studies	3
RLST 2660. World Religions	3
SPAN 1000. Introduction to Cultures of the Spanish Speaking World	3

ARTS: (3 hours) Choose one course from any of the following courses: FA, PMUS, THTR.

F A 1001. Introduction to Art	3
PMUS 1001. Music Appreciation	3
THTR 1001. Introduction to Theatre	3

INTERNATIONAL PERSPECTIVES: (3 hours) Choose one course from any of the following courses: ENGR, HIST, P SC.

ENGR 3600. International Dimensions of Culture and Technology	3
HIST 3899. Encounters in World History	3
P SC 3022. Introduction to Comparative Politics	3
P SC 3042. Introduction to International Relations	3

CULTURAL DIVERSITY: (3 hours) Choose one course from any of the following courses: ANTH, CMMU, ECON, ENGR, ETST, PHIL, PSY, SOC, THTR, HIST, MGMT, P SC, RLST.

	Semester Hours
ANTH 3142. Cultural Diversity in the Modern World	3
CMMU 3271. Communication and Diversity	3
ECON 3100. Economics of Race and Gender	3
ENGR 3400. Technology and Culture	3
ETST 3704. Culture, Racism and Alienation	3
ETST 3794. Ethnic Diversity in American Literature	3
HIST 3345. Immigration and Ethnicity in U.S. History	3
MGMT 4100. Managing Cultural Diversity	3
PHIL 3500. Ideology and Culture: Racism and Sexism	3
P SC 3034. Race, Gender, Law and Public Policy	3
P SC 3035. Political Movement: Race and Gender	3
PSY 4485. Psychology of Cultural Diversity	3
RLST 4000. Religion and Cultural Diversity	3
SOC 3020. Race and Ethnicity in the U.S.	3
THTR 3611. Drama of Diversity	3

BEHAVIORAL SCIENCES: (3 hours) Choose one course from any of the following courses: ANTH, CMMU, PSY.

ANTH 1302. Introduction to Archaeology	4
ANTH 2102. Culture and the Human Experience	3
CMMU 1011. Fundamentals of Communication	3
CMMU 1021. Fundamentals of Mass Communication	3
PSY 1000. Introduction to Psychology I	3
PSY 1005. Introduction to Psychology II	3

INTELLECTUAL COMPETENCIES* (6 hours)

ENGL 1020. Core Composition I**	3
ENGL 2030. Core Composition II	3
TOTAL SEMESTER HOURS:	24-25

Please note the above core list does not include mathematics or biological and physical sciences due to the extensive math and physics curricula required by the College of Engineering and Applied Science. Please see the Engineering Student Services advisor for questions.

*English 1020 and English 2030 are the only approved composition courses for the UCDHSC Core Curriculum.

**English 1020 should be taken the first semester a student is enrolled at UCDHSC.

Counseling

Personal counseling is available through the UCDHSC Student and Community Counseling Center. Contact 303-556-4372 for questions or an appointment.

Course Load Policy

Full-time Students. Undergraduate students employed less than 10 hours per week should register for the regular work as outlined in the departmental curricula. Additional courses may be allowed when there is satisfactory evidence that the student has the capability to handle the added load. Permission to take more than 21 hours may be granted only after written petition and approval of the department chair and the dean.

Employed Students. Suggested maximum course loads for undergraduate students employed 10 or more hours per week are as follows:

Employed 40 or more hours per week—two courses (maximum of 9 semester hours)
Employed 30 hours per week—three courses (maximum of 12 semester hours)
Employed 20 hours per week—four courses (maximum of 15 semester hours)
Employed 10 hours per week—five courses (maximum of 18 semester hours)

Freshman Year

Fundamentals taught in the freshman year are of critical importance in the more advanced classes. Special attention should be given to taking courses in the proper sequence. (Course requirements for freshmen are detailed within the typical curriculum given under each department.)

All freshmen are urged to consult their instructors whenever they need help.

Repetition of Courses

Students may not register for credit in a course in which they already have received a grade of *C*– or higher. An *F* grade in a required course necessitates subsequent satisfactory completion of the course. Students must repeat a course in which a grade of *D*+ or lower was earned, if that course is a prerequisite to another required course. If students do not successfully complete (*C*– or higher) an engineering class on the second attempt, they must obtain written approval from their major department to enroll for the course for the third time. When a course is retaken because of a *D* or *F* grade on the first attempt, both grades will appear in the transcript and both will be averaged into the GPA.

No Credit

An engineering student must petition for approval before enrolling for no credit (*NC*) for any course. Required courses may not be taken for no credit. Once a course has been taken *NC*, the course cannot be repeated for credit.

Work Experience

The College of Engineering and Applied Science does not award academic credit for work experience.

College Policy on Academic Progress

All undergraduate students must declare a major by the time they have accumulated 60 semester hours. An engineering student must maintain a cumulative GPA of 2.0 or better in all hours attempted at the University of Colorado, in those courses applied toward graduation requirements and in all courses taken from the student's major department in order to remain in good standing in the College of Engineering and Applied Science. Grades earned at another institution are not used in calculating the GPA at the University of Colorado. However, grades earned in another school or college of the University of Colorado will be used in determining the student's scholastic standing and progress or lack of progress toward the bachelor of science degree in the College of Engineering and Applied Science.

Students whose cumulative CU GPA falls below 2.0 will be placed on probation for the next semester in which they are enrolled in the college and will be so notified. If after the probationary semester the student's cumulative GPA is still below 2.0, the student will be suspended from the college.

The following conditions apply:

1. During a probation semester, the student must complete a normal load, i.e., 12 semester hours or more (see employed student suggested course load) of courses counting toward graduation requirements. Physical education courses do not count; if the student has previously completed 6 semester hours of ROTC courses, ROTC courses do not count; if the required hours of humanities and social science subjects have been completed, such subjects do not count.
2. Students are suspended indefinitely and may not enroll at any University of Colorado campus during any regular academic year, September through May, but may enroll in summer sessions and/or may take correspondence courses for credit through the Division of Continuing Education in Boulder.
3. Students who have been suspended may apply for re-admission if they bring their University of Colorado cumulative GPA up to a 2.0 through summer session and/or correspondence work applying to engineering degree requirements.
4. Upon satisfactorily completing a minimum of 12 semester hours of acceptable work appropriate to an engineering curriculum at another college or university, subsequent to suspension, students may apply for re-admission as a transfer student during the second semester following their suspension.
5. Applicants for re-admission to the University of Colorado cannot be assured of re-admission.
6. Students who have been on probation or suspension at any time in the past will automatically be suspended again if their cumulative GPA falls below a 2.0. (No additional probationary semester is permitted.)

Details of the probationary and suspension status and of the conditions for return to good academic standing will be stipulated in the letters of probation and suspension. Information regarding these matters may be obtained in the Office of the Dean, North Classroom 3024.

In addition to college policies, departments within the college may set standards of progress within their department, and students should make a point of knowing them.

Academic Ethics (Dishonesty, Cheating)

Students are expected to conduct themselves in accordance with the highest standards of honesty and integrity. Cheating, plagiarism, illegitimate possession and disposition of examinations, alteration, forgery or falsification of official records and similar acts or attempts to engage in such acts are grounds for suspension or expulsion from the university.

In particular, students are advised that plagiarism consists of any act involving the offering of the work of someone else as the student's own.

At the downtown Denver campus of UCDHSC, there is a student Academic Honor Code. The code is published in a brochure available from the Office of Student Life. Information regarding all student grievance procedures may be obtained in that office.

In addition, the college has a committee on discipline that hears cases of alleged violations of academic ethics and recommends disciplinary action. In a case of proven academic dishonesty/misconduct, the committee may invoke penalties that may include probation,

suspension or expulsion. In a case of suspension or expulsion, a distinction may be placed on a student's academic record indicating the action was due to academic dishonesty/misconduct. Students who suspect or observe violations of academic ethics should report them to their instructor, the department chair or the Office of the Dean.

Grading System, Incompletes, Pass/Fail and Drop/Add Procedures

See the Registration and Records chapter of this catalog for the University of Colorado uniform grading system and for additional pass/fail information and drop/add procedures.

Final grades, as reported by instructors, are to be considered permanent and final. Grade changes will be considered only in cases of documented clerical error and must be approved by the dean.

INCOMPLETES

An incomplete *may* be given by the instructor for circumstances beyond the student's control, such as a documented medical or personal emergency. When it is given, the student, the Office of the Dean and the departmental office are informed in writing by the instructor, who states what the student is to do in order to remove the incomplete and the date the tasks are to be completed. The instructor may assign only the *I/F* grade. The student is expected to complete the course requirements (e.g., the final examination or term paper), within the established deadline and not to retake the entire course. The grade will be converted automatically to a grade of *F* after one year if the specified work is not completed.

PASS/FAIL

The primary purpose for offering courses on a pass/fail grade basis is to encourage students, especially juniors and seniors, to broaden their educational experience by electing challenging upper-division humanities and social sciences elective courses without serious risk to their academic records. In general, pass/fail should be limited to 3000- or 4000-level humanities and social sciences courses. Students must process the pass/fail form during the first two weeks of the semester. Engineering students cannot take required courses pass/fail. Below are specific pass/fail regulations for the College of Engineering and Applied Science:

1. A maximum of 16 pass/fail semester hours may be included in a student's total program. A maximum of 6 semester hours may be taken in one semester, but it is recommended that not more than one course at a time be taken pass/fail.
2. Courses that a student may elect to take pass/fail shall be designated and *approved in advance* by the student's major department. If courses not so designated are taken, the earned grade will be recorded in place of the *P*. An engineering student who has not designated a major field will not be allowed the pass/fail option without approval through the Office of the Dean.
3. A transfer student may count toward graduation 1 semester hour of pass/fail for each 9 semester hours completed in the college; however, the maximum number of pass/fail semester hours counting toward graduation shall not exceed 16, including courses taken in the honors program under that program's pass/fail grading system.

DROPPING

After the tenth week of the semester, dropping a course requires a petition signed by the department chair and the dean. Only under very extenuating circumstances, such as a documented medical or personal emergency, will petitions for dropping courses be approved after the tenth week of the semester.

Sequence of Courses

Full-time students must generally complete the courses in the department in which they are registered, according to the typical curriculum shown under their major department in this catalog. Part-time students may modify the order of courses with their advisor's approval.

Graduation with Honors

In recognition of high scholarship and professional attainments, *Honors, Special Honors or With Distinction* may be awarded at graduation at the discretion of the student's major department. These honors are recorded on the diploma of the graduate and indicated in the commencement program. Grades earned during the semester of graduation will not be considered.

For *Special Honors,* a student must have a cumulative GPA of at least 3.80, and for *Honors,* a GPA between 3.60 and 3.79. *With Distinction* is awarded at the discretion of the College Executive Council.

Transfer students, to be considered for honors, will be expected to complete a minimum of one-half of their work at the University of Colorado. Grades earned at other institutions will not be considered. Transfer students must have completed at least 54 semester hours at CU before their last semester and must have a minimum of 64 semester hours completed at graduation.

PLANNING AN ENGINEERING PROGRAM

It is the responsibility of all students:

- to meet with their department transfer credit advisor as necessary
- to meet with their department academic advisor at least once each year
- to meet with their department senior check-out advisor prior to their last 30 semester hours of course work to finalize a graduation program that will be reviewed by the dean's office
- to complete a graduation contract and an application for diploma card before or during the first two weeks of their last semester
- to keep their senior check-out advisor informed of any changes in the student's plans throughout their last year

Graduation Requirements

In order to become eligible for one of the bachelor's degrees in the College of Engineering and Applied Science, a student, in addition to being in good standing in the university, must meet the following minimum requirements:

Courses—The prescribed and elective work in any curriculum as determined by the appropriate department must be completed satisfactorily.

Hours—A minimum of 130 semester hours is required for students seeking a civil engineering degree; a minimum of 128 semester hours for computer science or engineering, electrical engineering or mechanical engineering degrees.

Hours in Residence—At least 30 semester hours of course work applicable to a bachelor of science degree in engineering must be taken at the downtown Denver campus while a declared student in good standing at the College of Engineering and Applied Science. Students must be enrolled in the college for at least the final two semesters prior to graduation.

Transfer Credit—All requests for consideration of transfer credit and its application toward a degree in Engineering and Applied Science must be submitted prior to the student's last two semesters at the downtown Denver campus.

Grade Point Average—A minimum GPA of 2.0 (*C*) is required for all courses attempted, for all required courses and for all courses taken from the student's major department.

Assessment Test—An assessment test must be passed during the senior year. The test may be the Fundamentals of Engineering exam or

other exam as designated by the department. Students should check with their department for details.

Faculty Recommendation—The recommendation of the faculty of the department offering the degree and the approval of the faculty of the College of Engineering and Applied Science is required.

Incompletes and Correspondence Courses—It is the student's responsibility to ensure that all incompletes and correspondence courses are officially completed before the tenth week of the student's final semester in school.

Simultaneous Conferring of Degrees—For any double degree program, both bachelor's degrees must be conferred at the same commencement.

Commencement Exercises—Commencement exercises are held in December and May. A student finishing in August is encouraged to attend commencement the following December, but may request that the diploma be mailed.

UNDERGRADUATE DEGREES

In addition to the standard four-year degree programs previously listed, the college is involved in double degree programs.

Business and Engineering

Undergraduates in the College of Engineering and Applied Science with career interests in management may complete all of the requirements for both a BS degree in engineering and a BS degree in business administration by extending their study programs to five years, including one or two summer terms. The business courses required by the Business School may be started in the second, third or fourth year, depending upon the curriculum plan for the particular field of engineering in which the student is enrolled.

Students interested in this undergraduate program are required to submit an application to the Business School. Students should contact a business advisor to obtain the application form and determine an acceptable degree program.

Requirements for the undergraduate business degree and engineering degree must be completed concurrently. At least a 2.0 GPA must be earned in all business courses undertaken in the Business School. No fewer than 30 semester credits in business courses from UCDHSC must be earned after admission to business to establish residency credit. Courses offered or required by the Business School may be used in lieu of electives required for undergraduate engineering degrees, subject to the approval of the individual department.

Joint Engineering Degrees

A student may obtain two engineering majors by meeting the requirements of both programs; however, the approval of both departments and the dean is required. Thirty hours of elective or required subjects must be completed in addition to the largest minimum number required by either of the two departments. A course taken for one completed master's degree may not be counted toward a second master's degree.

Premedicine Option

A professional school in a field such as medicine requires a student to have a college education prior to pursuing its professional courses. In practically all cases, medical students are university graduates, although occasionally a student may enter medical school after three years of university training.

The desirability of obtaining an engineering education prior to undertaking a study of medicine is increasing continually as medicine itself is evolving. A great deal of new equipment, most of it electronic, is being developed to assist the medical practitioner in treatment of patients. Bioengineering, engineering systems analysis, probability and communication theory are highly applicable to medical problems. Improved communication techniques also are allowing the storage and retrieval of information not previously available to the medical doctor. An advanced knowledge of basic mathematics and computing techniques, along with increased understanding of physical chemistry, improves the scientific base upon which medical knowledge rests. It is therefore desirable that the future medical practitioner and researcher be well equipped with the tools engineering can offer.

To provide a minimum of the necessary knowledge, the additional courses listed below must be completed with superior grades. Students can meet these requirements by careful substitution of electives in the engineering curriculum. In some cases where additional hours may be required, interested students should consult with the engineering department chair.

	Semester Hours
General Chemistry (two semesters) (CHEM 2031, 2038, 2061, 2068)	9
Organic Chemistry (two semesters) (CHEM 3411, 3421, 3418, 3428)	10
General Biology (two semesters) (BIOL 2051, 2061, 2071, 2081)	8
English Composition (one semester)	3
Literature (two semesters)	6
Total	36

Students desiring to enter a premedical program should consult the representative of the department involved. On the downtown Denver campus, premedical advising is available through the health careers advisor, North Classroom, 3014B, 303-556-4350.

GRADUATE STUDY IN ENGINEERING

The College of Engineering and Applied Science at UCDHSC offers graduate programs in civil engineering, computer science, electrical engineering, mechanical engineering and computer sciences and engineering.

For information regarding courses and requirements leading to the master of science, master of engineering, or the PhD degree, see the appropriate discipline heading in this section. For graduate admission information and policies, see the Information for Graduate Students chapter of this catalog.

Education for Employed Professional Engineers

Continuing education for employed engineers grows more important each year. Therefore, the college puts great emphasis upon making graduate courses available through evening and televised courses. The master of engineering degree permits graduate students more flexibility in defining specialized interdisciplinary fields that meet their professional needs. This degree has standards equivalent to those of the master of science degree.

In addition to credit course work, the college also offers courses of interest to practicing engineers through its Continuing Engineering Education Program, 303-556-4907. (See also information under "Continuing Engineering Education Program" in this chapter.)

Concurrent BS and MS Degree Program in Engineering

A student who plans to continue on to graduate study after completing the requirements for the BS degree may be admitted to a graduate program through his/her major department in the senior year (after completion of at least 110 semester hours). Requirements are the same as for the two degrees taken separately: 128 or 130 semester hours, depending on the major, for the BS degree; and 30 semester hours for the MS degree. Humanities and social sciences requirements must be completed within the first 136 semester hours. A 3.0 GPA for all work attempted through the first six semesters (at least 96 semester hours) and written recommendations from at least two major-field faculty members are required.

The purpose of the concurrent degree program is to allow students who qualify for graduate study and expect to continue for an advanced degree to plan their graduate program from the beginning of the senior year rather than from the first year of graduate study. The student can then reach the degree of proficiency required to begin research at an earlier time and can make better and fuller use of courses offered only in alternate years.

Students will be assigned faculty advisors to help them develop the program best suited to their particular interests. Those in the program will be encouraged to pursue independent study on research problems or in areas of specialization where no formal courses are offered. A liberal substitution policy will be followed for courses normally required in the last year of the undergraduate curriculum. The program selected must be planned so that the student may qualify for a BS degree after completing the semester-hour requirements for the degree, if the student so elects, or if the student's GPA falls below the 3.0 required to remain in the program. In this case, all hours completed with a passing grade while in the program will count toward fulfilling the normal requirements for the BS degree.

There will be no credit given toward a graduate degree for courses applied to the BS degree requirements.

Graduate Work in Business

Undergraduates in engineering who intend to pursue graduate study in business may complete some of the business background requirements as electives in their undergraduate programs. Seniors in engineering who have such intentions and appear likely to qualify for admission to graduate study in business may be permitted to register for graduate fundamentals courses, which are designed to provide qualified students with needed background preparation in business. Students must see an advisor from the Business School for approval.

PROGRAMS OF STUDY

Courses listed in the following curricula are typical illustrations. Changes in specific courses may be necessary to accommodate students' needs and/or changes in institution requirements; however, students should take courses in logical sequence, i.e., complete all freshman courses before taking sophomore courses.

Civil Engineering

Chair: Bruce N. Janson
Program Assistant: Mindy R. Gewuerz
Office: North Classroom, 3027
Telephone: 303-556-2871
Fax: 303-556-2368

FACULTY

Professors: Nien-Yin Chang, PhD, Ohio State University, Professional Engineer (PE)—Ohio and Colorado; James C.-Y. Guo, PhD, University of Illinois at Urbana-Champaign, PE—Colorado; Bruce N. Janson, PhD, University of Illinois; Lynn E. Johnson, PhD, Cornell, PE—Connecticut; Jonathan T. H. Wu, PhD, Purdue
Associate Professors: Anu Ramaswami, PhD, Carnegie Mellon; Kevin L. Rens, PhD, Iowa State University, PE—Colorado
Assistant Professors: Stephan A. Durham, PhD, University of Arkansas; David C. Mays, PhD, University of California at Berkeley
Senior Instructor: Brian Brady, PhD, Colorado School of Mines
Associate Professor Adjunct: Michael Tang, PhD, University of Wisconsin at Madison
Professors Emeriti: Paul E. Bartlett, MS, University of Colorado, PE—Colorado; David W. Hubly, PhD, Iowa State, PE—Colorado; Orem G. Strom, PhD, University of Texas at Austin

STATEMENT OF MISSION

The mission of the Department of Civil Engineering is to:

- deliver high-quality comprehensive degree programs (BS, MS, MEng, PhD) to all of our students at both the undergraduate and graduate levels
- matriculate students who excel in professional practice and leadership and who possess compassion and respect for people of all cultural backgrounds
- teach our classes with excellence, whether in a traditional classroom setting or online
- offer our students state-of-the-art laboratories, equipment and classrooms with the latest technology needed for a complete learning experience
- develop ambitious and innovative research programs involving both faculty and students through funding from federal, state and local sources
- provide supportive mentoring and guidance to our students through teaching, research and advising
- produce students who can work as leading professionals in civil engineering and in many other fields for which civil engineering knowledge can be a foundation

STATEMENT OF OBJECTIVES

The objectives of the bachelor of science in civil engineering program are to produce graduates who:

- are able to perform the technical analyses and design tasks of entry-level civil engineers
- can successfully work toward professional engineering licensure
- communicate effectively, both orally and in writing
- understand the importance of leadership skills, team building and ethical practice
- value lifelong learning and improvement through graduate degrees or professional study
- appreciate the importance of community involvement and social contribution

Civil engineers are dedicated to improving our living environment. They are responsible for the planning, design and construction of buildings, bridges, highways, water distribution systems, wastewater collection and treatment systems, solid waste treatment and disposal systems, airports, railroads, pipelines, water treatment plants, dams, geographic information systems and other parts of our infrastructure systems. In preparing for work in such a broad field, the civil engineering student studies mathematics, basic science, communication, social science and humanities, engineering science and civil engineering design. UCDHSC's civil engineering graduates usually find their first professional employment with consulting engineering firms, government agencies and various industries.

UNDERGRADUATE

The UCDHSC undergraduate civil engineering curriculum places balanced emphasis on four principal areas of civil engineering practice: structures, transportation, water and geotechnical engineering. In each of these areas, the student receives instruction in planning, design and analysis methods. Microcomputer skills are taught early in the program of study and used frequently in subsequent courses.

Typical Curriculum for BS (Civil Engineering)

A minimum of 130 semester hours is required to earn the BS degree. The faculty provide advising to help students develop an efficient study plan. The student must satisfactorily complete all the course work in the curriculum shown below, satisfy all university graduation requirements and maintain at least a 2.0 GPA in the civil engineering courses.

A typical four-year program of study is shown below.

FRESHMAN YEAR

First Semester	*Semester Hours*
MATH 1401. Analytical Geometry and Calculus I	4
CHEM 1130. Engineering General Chemistry *(see note 1)*	5
ENGL 1020. Core Composition I *(see note 2)*	3
Core Curriculum Elective *(see note 2)*	3
Total	15

Second Semester	
MATH 2411. Analytical Geometry and Calculus II	4
PHYS 2311. General Physics I	4
PHYS 2321. General Physics Laboratory I	1
C E 2212. Plane Surveying	3
ENGR 1025. Engineering Graphics and Computer-Aided Design	3
Core Curriculum Elective *(see note 2)*	3
Total	18

SOPHOMORE YEAR

First Semester	
MATH 2421. Calculus and Analytical Geometry III	4
PHYS 2331. General Physics II	4
C E 2121. Analytical Mechanics I	3
C E 2200. Computing Methods in Civil Engineering	3
Core Curriculum Elective *(see note 2)*	3
Total	17

Second Semester	
MATH 3195. Linear Algebra and Differential Equations	4
C E 3121. Mechanics of Materials	3
C E 3141. Materials Testing Laboratory	2
C E 3401. Introduction to Environmental Engineering	3
C E 4780. Engineering Geology	
—or—	
GEOL 1072. Physical Geology: Surface Processes	
—or—	
MATH 3800. Probability and Statistics for Engineers	3
Total	15

JUNIOR YEAR

First Semester	
C E 3111. Analytical Mechanics II	3
C E 3313. Theoretical Fluid Mechanics	3
C E 3505. Structural Analysis	3
C E 3602. Transportation Engineering	3
Core Curriculum Elective *(see note 2)*	3
Total	15

Second Semester	
C E 3323. Applied Fluid Mechanics	3
C E 3414. Design of Water and Wastewater Systems	3
C E 3708. Introduction to Geotechnical Engineering	3
C E 4718. Intermediate Soils Engineering	2
ENGR 3012. Thermodynamics	3
Core Curriculum Elective *(see note 2)*	3
Total	17

SENIOR YEAR

First Semester	
E E 3030. Electric Circuits and Systems	3
Civil Engineering Design Electives *(see note 3)*	6
Science, Math or Engineering Electives *(see note 4)*	6
Core Curriculum Elective *(see note 2)*	3
C E 4000. Senior Seminar	0
Total	18

Second Semester	*Semester Hours*
Civil Engineering Design Electives *(see note 3)*	6
C E 4067. Senior Design Project	3
Core Curriculum Elective *(see note 2)*	3
Science, Math or Engineering Elective *(see note 4)*	3
Total	15

Notes for BS (Civil Engineering)

1. Or CHEM 2031 and CHEM 2038, which are required for students wishing to take CHEM 2061 and CHEM 2068 as general electives.
2. The communication, humanities and social science electives selected by the student and approved by his/her advisor must satisfy the college core curriculum.
3. Students must satisfactorily complete four of the six civil engineering design courses listed below:
   - C E 4427. Storm Water System Design 3
   - C E 4565. Timber Structure Design 3
   - C E 4575. Structural Steel Design 3
   - C E 4585. Reinforced Concrete Design 3
   - C E 4602. Highway Engineering 3
   - C E 4738. Intermediate Foundation Engineering 3
4. Science, math or engineering electives. The purpose of the electives is to extend the student's knowledge beyond the basic civil engineering requirements. Electives chosen should come from the areas of engineering, mathematics, chemistry, biology, physics or geology. In the case of mathematics, chemistry, physics or geology, the elective must be of higher level than courses in this field required by the civil engineering program. At least one elective must be a civil engineering course. Suggested courses are C E 4077, C E 4087, C E design courses or any 5000-level C E course.

GRADUATE

Degree Programs

UCDHSC offers the master of science in civil engineering (MSCE) with emphases in the following areas: environmental engineering, geotechnical/geo-environmental engineering, structural engineering, transportation engineering, hydrology and water resources, and geographical information systems (GIS). The Department of Civil Engineering also offers the master of engineering (MEng) degree with an emphasis in either geographical information systems (GIS) or transportation. The PhD degree in civil engineering is offered through a coordinated program with CU-Boulder. For the convenience of working students, all graduate-level courses are scheduled in the evenings or on Saturdays.

Requirements for Admission

Applicants to the master of science in civil engineering (MSCE) program must satisfy all requirements specified in the Information for Graduate Students chapter of this catalog, have an ABET-accredited undergraduate degree in civil engineering and have an undergraduate GPA of 3.0 (on a 4-point scale) or better for regular admission. Students with lower GPAs may qualify for provisional admission and are strongly encouraged to submit GRE scores in such cases. International applicants are also encouraged to submit GRE scores to support their applications if needed. Applicants whose undergraduate degree is in a field other than civil engineering may also be admitted into the MSCE degree program, if they have or will complete undergraduate prerequisite courses as required by the Department of Civil Engineering and the student's graduate advisor.

Applicants to the master of engineering (MEng) program must have a baccalaureate degree in engineering, math, science, economics or planning from an accredited college or university and satisfy all requirements specified by the Graduate School.

Prospective PhD students should contact the Department of Civil Engineering on the downtown Denver campus to inquire about application requirements and to obtain the "Rules and Policies for the Coordinated PhD Program."

Degree Requirements

Two MSCE degree programs are available. Plan I includes a master's thesis, while Plan II includes a master's report. Both plans require a minimum of 30 semester hours.

Plan I requires 24 or more semester hours of graduate-level courses plus at least 6 semester credits for a thesis. Plan II requires 27 or more semester hours of graduate-level courses plus at least 3 credits for a report.

The MEng degree requires 27 or more credits of graduate-level courses plus at least 3 credits for a master's report. The MEng degree requires at least 15 semester hours of civil engineering courses, which can include the master's report and up to 15 semester hours of graduate-level courses in other disciplines.

Both the MSCE and MEng degrees require satisfactory completion of a written comprehensive exam and an oral defense of the master's thesis or master's report to a committee of at least three graduate faculty.

Every graduate student must also satisfy the degree requirements of the Graduate School on the downtown Denver campus, specified in the Information for Graduate Students chapter of this catalog. Both the MSCE and the MEng degree programs must be completed within seven years of the date the student begins the degree program.

Courses for both the MSCE and MEng degree programs are selected by mutual agreement of the student and his/her graduate advisor after admission to the degree program. The advisor may also specify undergraduate courses that must be completed before starting graduate course work but will not count toward the credit hour requirements for the degree. The student's thesis or report topic must also be approved by the graduate advisor.

Computer Science and Engineering

Chair: Bogdan Chlebus
Program Assistant: Frances Moore
Office: North Classroom, 2605
Telephone: 303-556-4083
Fax: 303-556-8369
Web: www.cse.cudenver.edu

FACULTY

Professors: Gita Alaghband, PhD, University of Colorado; Tom Altman, PhD, University of Pittsburgh; Krzysztof (Krys) Cios, PhD, University of Mining and Metallurgy, Kraków, Poland, DSc, Polish Academy of Science, MBA, University of Toledo, Ohio; John Clark, PhD, Massachusetts Institute of Technology; Boris Stilman, PhD, National Research Institute for Electrical Engineering, Moscow, Russia
Associate Professors: Bogdan Chlebus, DSc, Warsaw University, Poland; Min-Hyung Choi, PhD, University of Iowa
Assistant Professors: Ellen Gethner, PhD, University of British Columbia; Il Kyeun Ra, PhD, Syracuse University
Senior Instructor and Undergraduate Advisor: Will Trobaugh, MS, University of Colorado

MISSION AND OBJECTIVES

The mission of the computer science and engineering (CSE) department is to:

- provide high-quality education for undergraduates students in CSE, MS students in CS, and PhD students in CSIS
- encourage and support scholarly research activities by both faculty and students
- form partnerships with industry firms and agencies, both local and beyond, to address important computing and engineering problems
- offer a wide range of computing and information technology courses as a service to the university and professional community
- continue to exemplify leadership to students, businesses, professionals and the community at large

The objectives of the CSE bachelor of science program are to:

- produce graduates who are immediately productive professionals in computer science and engineering
- prepare students for graduate or professional study
- instill leadership skills
- produce graduates who are valued members of their community
- involve undergraduates in software design research

UNDERGRADUATE

Computer Science and Engineering Program

Computers as a combination of software and hardware have become significant to the whole of society. They affect the way in which business is conducted and the way people study and learn. Very important is the use of computers to develop new avenues of human communication, interaction and cooperation. Communication networks and the combination of text with audio and video are providing more people with fingertip access to a vast array of information and knowledge.

The computer scientist and engineer is a professional who must be prepared to apply his or her skills, knowledge and creativity in a rapidly changing field. The bachelor of science in computer science and engineering at UCDHSC prepares students for such creative work. The emphasis is on fundamental concepts and basic principles with a long useful life. The program is composed of five major study areas: mathematics, basic or engineering science, required computer science courses, technical electives and the downtown Denver campus core curriculum.

The computer science and engineering program has dual accreditation from the Computing Accreditation Commission (CAC) and the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET).

Computer Science and Engineering Curriculum

The mathematics, basic science and computer science core requirements give the student a broad exposure to the concepts, methods and practice of computer science and engineering; the student learns the fundamentals of producing solutions to problems.

Technical electives are chosen to add depth to a student's knowledge in an area of special interest.

The downtown Denver campus core curriculum is designed to give the student an exposure to knowledge outside his or her major. For students in the College of Engineering, courses in the humanities, social sciences and human communications are required.

To be awarded the bachelor of science in computer science and engineering, a student must satisfactorily complete all course work shown in the curriculum below, satisfy all university graduation requirements, and maintain at least a 2.0 GPA in all computer science courses attempted (see "Policy on Academic Progress" in the introductory section of this chapter). Students must meet with an undergraduate advisor each semester to assure that they are on track within the degree program and are aware of the current requirements of the program. An additional source of information is the "C SE Undergraduate Advising Handbook" or the department's Web site, www.cse.cudenver.edu. Students are required to set up an appointment with the senior check-out advisor before registering for the last 30 semester hours of their program. Upon completion of the 30-hour checkout, all students are required to schedule an appointment with the CSE undergraduate advisor to complete the graduation agreement. Prerequisites will be strictly enforced. *Note*: Prerequisites must be taken before a course that requires them; co-requisites may be taken before or concurrent with a course that requires them.

Typical Curriculum for BS in CSE

FRESHMAN YEAR

First Semester	*Semester Hours*
MATH 1401. Analytic Geometry and Calculus I	4
CHEM 1130. Engineering General Chemistry *(see Note 2)*	5
ENGL 1020. Core Composition I *(see Note 1)*	3
C SC 1410. Fundamentals of Computing	3
C SC 1510. Logic Design	3
Total	18

Second Semester	
MATH 2411. Analytic Geometry and Calculus II	4
PHYS 2311. General Physics I: Calculus-Based	4
PHYS 2321. General Physics Laboratory I	1
C SC 2312. Intermediate Programming	3
C SC 2421. Data Structures and Program Design	3
C SC 2531. Logic Laboratory	1
Total	16

SOPHOMORE YEAR

First Semester	
MATH 2421. Calculus and Analytic Geometry III	4
PHYS 2331. General Physics II: Calculus-Based	4
PHYS 2341. General Physics Laboratory II	1
C SC 2511. Discrete Structures	3
C SC 2525. Assembly Language and Computer Organization	3
C SC 2132. Circuit Analysis I	3
Total	18

Second Semester	
MATH 3195. Applied Linear Algebra/Elementary Differential Equations	4
C SC 3412. Algorithms	3
C SC 2142. Circuit Analysis II	3
ENGL 2030. English Composition II	3
Core Curriculum Elective *(see note 1)*	3
Total	16

JUNIOR YEAR

First Semester	
General Science Elective *(see Note 2)*	3
C SC 3415. Principles of Programming Languages	3
C SC 3651. Digital Hardware Design	3
Core Curriculum Electives *(see note 1)*	6
Total	15

Second Semester	
C SC 3453. Operating System Concepts	3
C SC 3645. Discrete Linear Systems	3
C SE Technical Elective *(see note 3)*	3
Core Curriculum Electives *(see note 1)*	6
Total	15

SENIOR YEAR

First Semester	
MATH 4650. Numerical Analysis I	3
C SC 4508. Introduction to Software Engineering	3
C SC 4535. Probability and Statistics	3
C SC 4591. Computer Architecture	3
C SE Technical Elective *(see note 3)*	3
Total	15

Second Semester	*Semester Hours*
C SC 4034. Theoretical Foundations of Computer Science	3
C SC 4735. Computers, Society and Ethics	3
C SC 4739. Senior Design Project	3
C SE Technical Elective *(see note 3)*	3
Core Curriculum Elective *(see note 1)*	3
Total	15

Notes for BS (Computer Science and Engineering)

In addition to planning for sequences of courses based on prerequisites, students should plan to complete sophomore-level courses before taking junior-level courses.

1. Downtown Denver campus core curriculum: core requirements of the College of Engineering and Applied Science are outlined in the section titled "Undergraduate Core Curriculum in Engineering" in this catalog or at www.cse.cudenver.edu. In the communication area, students must pass ENGL 1020-3. Core Composition I, with a *C–* or better prior to taking either C SC 2421 or C SC 4739.
2. The chemistry sequence CHEM 2031/CHEM 2038 may be substituted for CHEM 1130. In addition to the required chemistry and physics courses, students must take a general science elective chosen from basic or engineering science. Refer to the "C SE Undergraduate Advising Handbook" for further information.
3. Computer science and engineering technical electives: The student must take three courses (9 semester hours) chosen from any C SC 4000-level courses and/or any EE 4000-level computer engineering courses that are not part of the required bachelor of science in computer science and engineering (BSCSE) curriculum.

MINOR IN COMPUTER SCIENCE

The Department of Computer Science and Engineering offers a minor in computer science. The requirements for the minor are listed below.

1. Any undergraduate student currently enrolled in a UCDHSC degree program with a major other than computer science and engineering may earn a minor in computer science. This includes students from the College of Engineering and Applied Science, the College of Liberal Arts and Sciences, the Business School and College of Arts & Media and the School of Public Affairs.
2. The student must complete the following classes with a grade of *C–* or better.
   C SC 1410. Fundamentals of Computing
   C SC 2421. Data Structures and Program Design
   C SC 2511. Discrete Structures
   MATH 1401. Calculus and Analytical Geometry I
   MATH 2411. Calculus and Analytical Geometry II
3. The student must complete (with a *C-* or better) three additional computer science courses at the 3000 level or higher with the approval of an undergraduate advisor.
   Note: Some courses at the 3000 level and above require additional prerequisites. A student must fulfill all prerequisites for the courses he/she selects. See the catalog course descriptions for prerequisite information for each course.
4. All computer science courses 3000-level and above must be taken at the downtown Denver campus of UCDHSC.
5. At the time of graduation, the student must have a UCDHSC cumulative GPA of 2.0 and must have a 2.0 GPA for the eight classes taken for the minor.
6. The student must file a minor declaration form with an undergraduate advisor or with the Engineering Student Services office in North Classroom 3024. For more information or an advising appointment, contact the Department of Computer Science and Engineering in North Classroom 2605 or by phone at 303-556-4314.

GRADUATE

The Department of Computer Science and Engineering (CSE) offers a master of science in computer science (MSCS), including an option in computational biology. The CSE department, together with the Business School, also offers a joint program leading to a doctoral degree in computer science and information systems (CSIS).

Research areas of emphasis include algorithms, artificial intelligence, automata theory, data mining and knowledge discovery, graphics, machine learning, networks, parallel and distributed processing and simulation. Only graduate students can take graduate courses.

Admission Requirements

Applicants should hold a bachelor's degree in engineering or science. They should have considerable programming experience.

Prerequisites

Applicants should have had the equivalent of the following University of Colorado courses:

C SC 1410. Fundamentals of Computing
C SC 2421. Data Structures and Program Design
C SC 2511. Discrete Structures

In addition, applicants should have had at least three upper division computer science courses, such as the following:

C SC 3412. Algorithms
C SC 3415. Principles of Programming Languages
C SC 3453. Operating System Concepts
C SC 4034. Theoretical Foundations of Computer Science
C SC 4591. Computer Architecture
C SC 4508. Introduction to Software Engineering

Additional requirements include (1) 10 semester hours of university-level calculus and (2) at least one math course beyond calculus, such as advanced calculus, differential equations, linear algebra, probability, statistics or combinatorial anaylsis.

Students lacking some of these courses must complete them after admission.

Required GPA

Applicants should have a GPA of at least 2.75. If the GPA is below 2.75 but above 2.50, and/or some prerequisites are lacking, an applicant may be accepted as a provisional degree student.

GRE Exam

Applicants whose GPA is below 2.75 must submit GRE results (verbal, quantitative and analytical); a score of at least 1600 is required.

TOEFL Exam

International students must take the Test of English as a Foreign Language (TOEFL) and score a minimum of 500 (paper based) or 173 (computer based).

Transfer Credit

A maximum of 9 semester hours of graduate course work may be transferred into the program based on department approval.

Note: A student applying for MS study will be evaluated by the department's graduate advisor using the above specified rules and requirements. The admission letter will be sent to the student by the CSE chair. A student in Plan I (see below) should immediately choose a full-time faculty member as permanent thesis advisor based on his or her area of interest. The permanent thesis advisor, in cooperation with the student will form a thesis committee.

General MS Degree Requirements

In addition to the basic requirements of the university, the Department of Computer Science and Engineering requires master's degree candidates to complete an approved program of study consisting of at least 30 semester hours of graduate-level computer courses while maintaining a GPA of at least 3.0. With prior approval by an advisor, a student may substitute up to 6 semester hours of mathematics or other engineering courses. All courses must be taught by University of Colorado graduate faculty.

A student must submit an approved plan of study to the department during the first semester of his/her admission. An academic advisor will consult with each student to develop a plan of study.

Requirements for the MS in Computer Science Degree

Students may choose either Plan I (thesis) or Plan II (nonthesis).

Plan I—Thesis

Students choosing Plan I take 24 semester hours of graduate course work plus 6 semester hours of thesis work. Three courses must be chosen from among five core courses and three additional courses chosen from among more than a dozen "breadth" courses. All must be passed with a grade of *B* or better. Plan I students must also write a thesis and defend it before a thesis committee. The students in Plan I may take two independent study courses for a maximum of 6 hours.

Plan II—Non-Thesis

Students choosing Plan II take 30 semester hours of graduate course work. Three courses must be chosen from among five core courses and three additional courses chosen from among more than a dozen "breadth" courses. All must be passed with a grade of *B* or better. The students in Plan II may take only one independent study course for a maximum of 3 semester hours.

Notes:

1. Students in Plan I will have a priority in obtaining departmental teaching assistantships.
2. Students can take only graduate engineering (21 semester hours must be CS courses) and graduate mathematics courses. No more than 6 semester credits can be taken in the form of online courses.

Computational Biology Option

Required Courses	*Semester Hours*
BIOL 5099. Biology for Computer Scientists, Engineers and Mathematicians*	3
C SC 5610. Computational Biology	3
C SC 5451. Algorithms	3
C SC 5840. Directed Study: Complex Programming Project	3
MATH 5396. Introduction to Bayesian Statistics	3
Total	15

Note: C SC 5840. Directed Study: Complex Programming Project is a complex software development project that must be completed under the direction of a CU faculty member approved by the Center for Computational Biology director or one of the associate directors. Prerequisite: CSC 5610 and CSC 5451.

* If you have a strong background in biology, you can substitute an approved graduate course in biology or chemistry.

Adequate Progress Toward MS in Computer Science Degree

Students are expected to finish the MS degree program within seven years. Candidates for the MS degree may not get credit for a course taken longer than seven years before the date on which the degree is to be granted. A student may petition for an acceptance of a graduate course that was taken seven or more years prior to potential graduation.

Students who do not enroll for any course work relevant to computer science in a given semester (summer semesters excluded) must supply the Department of Computer Science and Engineering with a written

statement describing the reasons for the inactivity. This statement must be received by the department by the eighth week of that semester. The department shall regard the failure to supply such a statement as demonstrating a lack of interest in continuing in the program. Students who are inactive for three consecutive semesters (summer semesters excluded) can be removed from the program.

Thesis defense is to be completed by the ninth week of the semester of graduation.

PhD CSIS Program

Program co-directors: Bogdan Chlebus (CSE) and Mike Mannino (Business School)
Web site: www.csisphd.cudenver.edu

The Department of Computer Science and Engineering (CSE) and the Business School offer a joint doctor of philosophy degree program in computer science and information systems (CSIS). The program targets students with a master's-level education in either computer science or information systems who seek research training that combines CS and IS along with strong industry interaction. The joint PhD program provides training for academic positions, industrial research positions and senior consulting positions. The specific goals of the program complement these general goals:

- create a pool of graduates with CSIS research training who are qualified for academic and nonacademic careers
- meet student demand for advanced training in CSIS with accommodations for full-time and part-time students
- promote interdisciplinary research between CSE and the Business School
- enhance technology transfer between CSIS academic units and Front Range technology businesses through joint research, student internships, faculty externships and committee participation

ADMISSION

Prospective students apply to either the Department of Computer Science and Engineering (CSE) or the Business School. Applicants who pass the initial screening are then reviewed by a joint committee (consisting of the two co-directors of the program) for the final admittance decision.

Admission criteria include GPA (undergraduate and graduate), standardized test scores (GMAT or GRE), letters of recommendation, prior achievements in academia and industry, an application portfolio essay describing an applicant's motivation and an initial plan for doctoral study. The application portfolio is important to gauge an applicant's motivation for research training.

Students without a master's degree in either computer science or information systems will need to take additional course work sufficient to complete the requirements of a master's degree in one of the two areas.

PROGRAM ORGANIZATION

Supervision of the PhD Program

The PhD program is supervised by the two program co-directors. The duties of the co-directors include scheduling of doctoral courses, setting program policies subject to approval of business and CSE faculty, working with advisors ensure compliance with the program guidelines, resolving disputes, measuring performance of the program over time and providing the final decision on admittance of students.

Advisor

Upon entering the program, each student chooses an advisor to provide mentoring and guidance throughout the program and work with the student to prepare a program of study. The advisor will also work with the student in the preparation of the first-year and second-year papers. Requests to change advisors must be approved by the program co-directors, and this happens in very rare circumstances.

Doctoral Committee

The advisor and four other members form a doctoral committee. To foster interdisciplinary work, students can have their doctoral research co-supervised by two faculty members from CSE and the Business School. There is at least one faculty member from CSE and at least one from business. One of the committee members is a representative of industry. At least one faculty committee member is from outside CSE and business. If the student has difficulty finding an industry representative, the advisor and the program co-directors help identify an industry representative.

PROGRAM COMPONENTS

Plan of Study

A list of course work and other requirements for the degree should be prepared with the advisor and then submitted to the co-directors for approval. The successful completion of all work indicated on the plan of study is an important prerequisite for the conferring of the degree. A plan of study should be submitted for approval by the end of the first semester of the program. The current plan of study should be updated before the beginning of the second year of the program and submitted for re-approval by the co-directors.

First- and Second-Year Papers

Students prepare papers during their second and third years. For part-time students, the timing might be longer in which case a prior approval by the advisor is required. The papers should be of high quality to ensure publication in conference proceedings or journals. The advisor serves as a mentor to help the student complete these papers, and each paper is submitted for approval to the advisor. An industry representative may also be used as an evaluator.

Comprehensive Exam

After completing the required course work, each student will take a written comprehensive exam that requires integration of computer science and information systems knowledge. The program co-directors will solicit questions from faculty, schedule the examination and coordinate with faculty to grade the exam. The exam will normally take place over one day, about eight hours.

Dissertation Proposal

As the first phase of the dissertation, each student should prepare a proposal that will be evaluated by the doctoral committee. A proposal should be ready for review at least one semester before the expected completion date of the degree. The proposal is submitted for review and approval by the doctoral committee. An oral presentation of the dissertation proposal before the doctoral committee is required for approval. An approved proposal is then submitted to the co-directors of the program for final approval.

Dissertation Completion

Once the dissertation proposal is approved, each student prepares and submits a dissertation. The dissertation is defended before the doctoral committee in a public meeting. Final approval for the dissertation is given by a vote of the dissertation committee after the public defense.

Graduation

Upon completion of all degree requirements including the dissertation defense, the student receives the degree of doctor of philosophy. Students applying through CSE receive the PhD from the College of Engineering and Applied Sciences, while students applying through information systems receive the PhD from the Business School.

Electrical Engineering

Acting Chair: Renjeng Su
Program Assistant: Helen Frey
Office: North Classroom 2615
Telephone: 303-556-2872
Fax: 303-556-2383

FACULTY

Professors: Gary Leininger, PhD, State University of New York, Buffalo; Titsa Papantoni, PhD, University of Southern California, Professional Engineer (PE)—Greek Chamber of Professional Engineers and Texas; Renjeng Su, PhD, Washington University
Associate Professors: Jan Bialasiewicz, PhD, DSc, Silesian Technical University, Poland, PE—Colorado; Hamid Fardi, PhD, University of Colorado; Miloje Radenković, University of Belgrade, Yugoslavia
Senior Instructors: Brian Atkinson, MS, University of Colorado; Robert Grabbe, MS, University of Colorado
Professor Adjunct: Carl Johnk, University of Illinois at Urbana-Champaign

Modern electrical engineering is a very broad and diverse field. As a profession, it rivals all other engineering disciplines in its impact on society. Never before has there been such a challenge and opportunity of electrical engineering to serve mankind. Today's electrical engineers are involved in the development of technology, materials and products to improve the quality of life. They are concerned with the generation and transmission of power, the control and utilization of natural and synthetic resources, the communication of data and information and the intelligent use of computers in consumer as well as industrial products and processes. Systems in electrical engineering range in size from microprocessors through megawatt energy conversion systems to global audio and video communication networks.

At UCDHSC, the electrical engineering curriculum prepares students for careers in product design, manufacturing, research, development, operation and plant engineering, technical sales and application engineering. The goal is to educate and inspire students to achieve their maximum career potential.

MISSION STATEMENT

We provide graduate programs and an ABET-accredited undergraduate program that are accessible to a diverse group of students—students of different racial and cultural backgrounds, full-time students as well as those who have considerable work and family commitments outside their academic learning, and students with a wide variety of work experiences.

UNDERGRADUATE PROGRAM OBJECTIVES

Objectives of the bachelor of science in electrical engineering are to develop graduates:

- who are immediately productive engineers and can advance their careers on different professional tracks in the engineering industry
- who can pursue graduate education in engineering or other fields such as business, medicine and law

These objectives are consistent with the mission of the University of Colorado at Denver and Health Sciences Center, congruent with the goals of the College of Engineering and Applied Science and reflective of the mission of the Department of Electrical Engineering.

UNDERGRADUATE CURRICULUM

Entering students begin their program with a solid foundation in mathematics, physics, chemistry and computers. Social science, humanities and communication courses provide a diverse background. Intensive courses follow in the theory and laboratory application of digital logic and electrical circuits, electromagnetic fields, electronics, computer engineering and digital hardware design, linear systems, controls, electrical machines and power systems, and microprocessors. Throughout the entire course of study, students reinforce their understanding of theory through laboratory experience and extensive design projects. A strong background is provided in all of the major fields of electrical engineering: circuits and electronics, microcomputers, signal and image processing, communications, autonomous and robotic systems, power and energy conversion, and automatic control systems and instrumentation. Ethics is an integral part of the curriculum. During the senior year, advanced undergraduate-level courses in different specialty areas, design projects and professional electives allow the student to explore areas of special interest.

Students should supplement this information about the curriculum by consulting a copy of the "E E Advisement Guide," which may be obtained in the Department of Electrical Engineering office located in North Classroom 2615. The "E E Advisement Guide" contains the latest information concerning the curriculum as well as guidelines and procedures with which each student should be familiar. To be awarded the bachelor of science in electrical engineering (BSEE), a student must satisfactorily complete 128 semester hours, satisfy all university graduation requirements and maintain at least a 2.0 GPA in all electrical engineering and computer science courses attempted. Appointments to see any of the departmental advisors may be made by calling 303-556-2872.

Typical Curriculum for BS (Electrical Engineering)

FRESHMAN YEAR

First Semester	*Semester Hours*
MATH 1401. Analytical Geometry and Calculus I	4
CHEM 1130. Engineering General Chemistry	5
ENGL 1020. Core Composition I *(see note 1)*	3
E E 1201. Intro to Electrical Engineering	1
E E 1510. Logic Design	3
Total	16
Second Semester	
MATH 2411. Analytical Geometry and Calculus II	4
PHYS 2311. General Physics I	4
PHYS 2321. General Physics Laboratory I	1
C SC 1320. Computing with "C"	3
E E 2531. Logic Laboratory	1
Core Curriculum Elective *(see note 1)*	3
Total	16

SOPHOMORE YEAR

First Semester	*Semester Hours*
MATH 2421. Calculus and Analytical Geometry III	4
MATH 3195. Linear Algebra/Differential Equations	4
PHYS 2331. General Physics II	4
E E 2132. Circuit Analysis I	3
ENGL 2030. Core Composition II *(see note 1)*	3
Total	18
Second Semester	
E E 2142. Circuit Analysis II	3
E E 2552. Sophomore Circuits Laboratory	1
E E 2651. Introduction to Computer Engineering	3
Core Curriculum Electives *(see note 1)*	6
Total	13

JUNIOR YEAR

First Semester	*Semester Hours*
E E 3133. Electromagnetic Fields	3
E E 3215. Electronics I	3
E E 3316. Linear Systems	3
E E 3651. Digital Hardware Design	3
E E 3715. Electronics Laboratory	1
Core Curriculum Elective *(see note 1)*	3
Total	16

Second Semester	*Semester Hours*
E E 3164. Energy Conversion	3
E E 3225. Electronics II	3
E E 3701. Computer Architecture and RTOS	3
E E 3724. Power Laboratory	1
E E 3735. Junior Laboratory	1
E E 3817. Engineering Probability and Statistics	3
Core Curriculum Elective *(see note 1)*	3
Total	17

SENIOR YEAR

First Semester	
E E 4309. Senior Design Project I	3
Professional Elective *(see note 3)*	3
Engineering Science Elective *(see note 4)*	3
E E Specialty and Laboratory *(see note 5)*	4
E E Specialty Course	3
Total	16

Second Semester	
E E 4319. Senior Design Project II *(see note 3)*	3
Professional Elective *(see note 4)*	3
E E Specialty and Laboratory *(see note 6)*	4
E E Specialty *(see note 6)*	3
Core Curriculum Elective *(see note 1)*	3
Total	16

Notes for BS (Electrical Engineering)

The particular curriculum to be satisfied by each student is the one published in the catalog current at the time of his/her 30-hour senior checkout. A graduation agreement should be requested by each student *after* completing registration for his/her last semester. Additional information is contained in the "E E Advisement Guide." Students should also refer to the section in this catalog on "Academic Policies of the College of Engineering and Applied Science."

1. Common core requirements of the College of Engineering and Applied Science are outlined in the section titled "Undergraduate Core Curriculum in Engineering" in this catalog or in the "E E Advisement Guide." In the communication area, students must pass ENGL 1020. Core Composition I, with a *C* or better prior to taking E E 2142. Circuit Analysis II, and E E 2552. Sophomore Circuits Laboratory.
2. All electrical engineering students must satisfactorily complete E E 4309. Senior Design Project I and E E 4319. Senior Design Project II in consecutive semesters.
3. Professional electives may be selected from an approved list of upper division or graduate-level courses or cooperative education. The electrical engineering advisor must be consulted prior to the selection of these electives.
4. The engineering science elective may be satisfied by taking ENGR 3012. Thermodynamics.
5. Seventeen semester hours of electrical engineering elective and specialty courses in association with the laboratories are required. Students are required to take at least two laboratories out of the following six groups. Theory components are either prerequisites or corequisites to the laboratory components. The theory component (without the laboratory) may be taken as a specialty course.

E E 4136. Control Systems Analysis	3
E E 4276. Digital Control Systems	3
E E 4406. Control Systems Laboratory	1
E E 4225. Advanced Electronics	3
E E 4435. Advanced Electronics Laboratory	1
E E 4247. Communication Theory	3
E E 4248. Digital Communication Systems	3
E E 4467. Communication Laboratory	1
E E 4133. Advanced Electromagnetic Fields	3
E E 4423. Microwave Laboratory	1
E E 4501. Microprocessor-based Design	3
E E 4521. Microprocessor Laboratory	1
E E 4511. Hardware-Software Interface Design	3
E E 4561. Hardware-Software Laboratory	1

Other courses available (without any laboratory component) as electrical engineering specialty courses include the following:

E E 4174. Industrial Power Electronics	3
E E 4184. Power Systems Analysis	3
E E 4555. VLSI Circuit Simulation	3

Computer Engineering Option

Students can add a computer engineering emphasis to their electrical engineering degree program by making the following changes in the curriculum described above:

JUNIOR YEAR

First Semester

Substitute E E 3651. Digital Hardware Design for E E 3817. Engineering Probability and Statistics.

Second Semester

Substitute E E 3817. Engineering Probability and Statistics, E E 3701. Computer Architecture and RTOS (real time operating system) for E E 3651. Digital Hardware Design, E E 3724. Power Laboratory and a humanities and social sciences course.

SENIOR YEAR

First Semester

Choose E E 4501. Microprocessor-based Design and E E 4521. Microprocessor Laboratory as one electrical engineering specialty and laboratory selection.

Second Semester

Choose E E 4511. Hardware-Software Interface Design, E E 4561. Hardware-Software Laboratory and a humanities and social sciences elective as professional elective and electrical engineering specialty and laboratory selections.

GRADUATE

The Department of Electrical Engineering offers graduate programs with the following areas of emphasis: systems and controls; signal and image processing; optics and communication systems; electrical power, machines and energy systems; microelectronics, VLSI and simulation; and computer engineering. The department offers graduate programs leading to the degrees of master of science in electrical engineering and master of engineering.

Requirements for Admission

Requests for applications for graduate study in electrical engineering should be addressed to Department of Electrical Engineering, UCDHSC, Campus Box 110, P.O. Box 173364, Denver, CO 80217-3364.

Applicants who are not citizens or permanent residents of the United States should make application through the Office of Admissions, Campus Box 167, P.O. Box 173364, Denver, CO 80217-3364. All applicants for admission need to submit complete credentials as outlined in the instruction sheet that accompanies the application materials.

Master of Science Program

The master of science (MS) program offers two plans, thesis (Plan I) and master's project (Plan II). In each, the student must complete 30 graduate semester hours. To satisfy the breadth requirement, two courses outside the area of specialization are required and two mathematics courses are recommended. Plan I requires a minimum of 24 semester hours of graduate course work and 6 semester hours of MS thesis work. Plan II requires a minimum of 27 semester hours of graduate course work and 3 semester hours of MS project. A minimum of 21 graduate semester hours must be earned through the electrical engineering department at UCDHSC. Candidates with a BS degree from UCDHSC can count 6 electrical engineering UCDHSC graduate credits toward both undergraduate and graduate degrees if their undergraduate GPA is at least 3.0. Double counting applies only to credits earned with a *B*– or better grade.

Master of Engineering Program

The master of engineering (MEng) degree program is broad based and is designed especially for that person who wants to further his/her education in more than just electrical engineering. A minimum of 30 semester hours of academic work is required for the MEng degree. At least 15 of these hours must be in electrical engineering courses at the 5000-level or above. At least 15 semester hours must be taken in the Department of Electrical Engineering at UCDHSC. As many as 15 semester hours may be taken outside of engineering. The student who wishes to enter the master of engineering program should apply to the electrical engineering department in the same manner as a master of science applicant.

Mechanical Engineering

Chair: Samuel W. J. Welch
Program Assistant: Petrina M. Morgan
Office: North Classroom, 3502
Telephone: 303-556-8516
Fax: 303-556-6371
Web site: www.cudenver.edu/engineer/mechanical/

FACULTY

Professors: Peter E. Jenkins, PhD, Purdue, MBA, Pepperdine, Professional Engineer (PE)—Texas; J. Kenneth Ortega, PhD, University of Colorado; John A. Trapp, PhD, University of California at Berkeley
Associate Professors: Ronald A. L. Rorrer, PhD, Virginia Polytechnic Institute and State University, PE—Colorado; L. Rafael Sanchez, PhD, Michigan Technological University; Samuel W. J. Welch, PhD, University of Colorado
Assistant Professors: Mohsen Tadi, PhD, Virginia Polytechnic Institute and State University; Sean E. Wright, PhD, University of Victoria
Senior Instructor: Joseph F. Cullen, Jr., MS, University of Colorado
Professor Emeritus: James Gerdeen, PhD, Stanford University

MISSION STATEMENT

The mission of the Department of Mechanical Engineering is to contribute to the economic development of the state of Colorado and the Denver metropolitan area by providing high-quality bachelor's and master's programs (BS, MS/ME) in mechanical engineering for a diverse group of working students.

EDUCATIONAL OBJECTIVES

The program offered by the Department of Mechanical Engineering of the University of Colorado at Denver and Health Sciences Center can be completed in the afternoon and evening hours to accommodate both working and traditional students. The department seeks to graduate a diverse population of students with bachelor's and master's degrees, enabling them to:

- be employed by a diverse group of industries, research laboratories and educational institutions
- pursue careers in traditional engineering, interdisciplinary areas, research and education
- pursue postgraduate education and advanced degrees

UNDERGRADUATE

The mechanical engineer is concerned with satisfying the needs of society using a combination of material, human and economic resources. Mechanical engineering covers a wide spectrum of activities in the engineering profession. These activities include the conversion and transmission of energy and associated power processes; the kinematic, dynamic, strength and wear considerations, as well as economic aspects of the development, design, and use of materials, machines and processes; and the analysis, synthesis and control of entire engineering systems.

The mechanical engineering curriculum begins with a strong emphasis on mathematics, physics and chemistry. It continues with a concentration in engineering sciences, including solid and fluid mechanics; thermodynamics, heat and mass transport; materials; and systems analysis and control. It concludes with laboratory and design courses that demonstrate the ways in which scientific knowledge is applied in the design and development of useful devices and manufacturing processes.

The mechanical engineering program may be roughly subdivided into two-year groupings. In the first two years, the program emphasizes the fundamentals of mathematics and basic science that are essential for an understanding of most branches of engineering. In the last two years of the program, the curriculum emphasizes engineering science and design and provides technical electives in the following areas:

thermodynamics
heat transfer
fluid mechanics
solid mechanics
power
bioengineering
dynamics and controls
computer-aided design and manufacturing
thermomechanical systems
composite materials

To be awarded the BS (ME), a student must complete a minimum of 128 semester hours of course work, must satisfy all university graduation requirements, and maintain at least a 2.0 in all mechanical engineering courses. All students are required to set up an appointment with the senior check-out advisor before registering for the last 30 hours of their degree program. The last 30 hours must be earned as a degree student in the College of Engineering at UCDHSC.

Typical Curriculum for BS (Mechanical Engineering—*see note 5*)

FRESHMAN YEAR

First Semester	*Semester Hours*
MATH 1401. Calculus I	4
CHEM 1130. Engineering General Chemistry	5
ENGR 1025. Engineering Graphics and Computer-Aided Design	3
ENGL 1020. Core Composition I *(see note 2)*	3
Total	15
Second Semester	
MATH 2411. Calculus II	4
PHYS 2311. General Physics I: Calculus-Based	4
PHYS 2321. General Physics Laboratory I	1
Core Curriculum Elective *(see note 1)*	3
M E Technical Elective—lower level *(see note 4)*	3
Total	15

SOPHOMORE YEAR

First Semester	*Semester Hours*
MATH 2421. Calculus III	4
PHYS 2331. General Physics II: Calculus Based	4
PHYS 2341. General Physics Laboratory II	1
M E 2023. Statics *(see note 3)*	3
Core Curriculum Electives *(see note 1)*	6
Total	18

Second Semester	
MATH 3195. Linear Algebra and Differential Equations	4
ENGR 3012. Thermodynamics I	3
M E 2033. Dynamics *(see note 3)*	3
M E 3030. Electric Circuits and Systems	3
M E 3032. Electric Circuits and Systems Laboratory	1
ENGL 2030. Core Composition II	3
Total	17

JUNIOR YEAR

First Semester	
M E 3010. Elementary Numerical Methods and Programming	3
M E 3021. Introduction to Fluid Mechanics	3
M E 3022. Thermodynamics II	3
M E 3027. Measurements	3
M E 3043. Strength of Materials	3
M E 3028. Laboratory of Mechanical Measurements	1
Total	16

Second Semester	
M E 3023. System Dynamics I: Vibrations	3
M E 3024. Introduction to Materials Science I	3
M E 3031. Fluids/Thermal Laboratory	1
M E 3034. Properties of Engineering Materials Laboratory	1
M E 3035. Design of Mechanical Elements	3
M E 3042. Heat Transfer	3
M E 3065. Intermediate Dynamics	3
Total	17

SENIOR YEAR

First Semester	
M E 3145. Manufacturing Process Design	3
M E 4023. System Dynamics II: Controls	3
M E 4035. Senior Design I	3
M E Technical Electives	3
Core Curriculum Elective *(see note 1)*	3
Total	15

Second Semester	
M E 4045. Senior Design II	3
M E Technical Electives	6
Core Curriculum Electives *(see note 1)*	6
Total	15

Notes for BS (Mechanical Engineering)

Students should check with departmental advisors to determine their degree requirements. The particular curriculum to be satisfied by each student is the one published in the catalog *current* at the time of their 30-hour senior checkout. For additional information, see the departmental advisor.

Students should refer to the section in this chapter on "Academic Policies" of the College of Engineering and Applied Science. In addition to planning for sequences of courses based on prerequisites, students should plan to complete sophomore-level courses before taking junior-level courses and should have completed their junior-level mechanical engineering courses before starting their senior-level mechanical engineering electives. All students should see their advisors at least once each semester.

1. Common core requirements of the College of Engineering and Applied Science. Refer to the "Undergraduate Core Curriculum in Engineering" in this catalog or to the "Common Core Requirements" guide available from your advisor for further information.
2. The communication requirements include ENGL 1020. Core Composition I and ENGL 2030. Core Composition II.
3. C E 2121 and 3111 may be substituted for M E 2023 and 2033.
4. Not all courses may be offered every semester. Students should check the current *Schedule Planner.*
5. Students enrolled prior to fall 2006 may choose either the new core curriculum or the old core curriculum.

GRADUATE

The Department of Mechanical Engineering offers graduate courses, a master of science degree program and a master of engineering program. The PhD in mechanical engineering is offered through the Department of Mechanical Engineering, University of Colorado at Boulder. The areas of research interest in which a student may undertake studies at the downtown Denver campus include manufacturing processes, fluid mechanics, solid mechanics, heat transfer, bioengineering, thermodynamics, composite materials and mechanical design.

Master of Science Degree Requirements

At the MS degree level, students may choose between two plans, with each plan totaling 30 semester hours. Students following Plan I take 24 hours of formal course work plus 6 semester hours of thesis. Students following Plan II take 30 hours of formal course work. Students in either plan may choose one of three options. In the first two options, the student may choose to specialize in either thermal sciences or mechanics. The third option is the general mechanical engineering option.

The thermal science option requires 12 semester hours of analytical methods, numerical methods, fluid mechanics and thermodynamics. The student then selects 9 semester hours of course work in approved electives from a selection of thermal science electives. The mechanics option requires 12 semester hours of course work in analytical methods, numerical methods, elasticity and dynamics. The student then selects 9 semester hours of course work in approved electives from a selection of mechanics electives. For students following Plan I, the thermal science and mechanics options both allow the student to pick one approved elective, not necessarily in the chosen specialty. For students following Plan II, the thermal science and mechanics options both allow the student to pick three approved electives, not necessarily in the chosen specialty.

The general mechanical engineering option requires the student to take 18 semester hours of required courses in analytical methods, numerical methods, fluid mechanics, thermodynamics, elasticity and dynamics. For students following Plan I, the general mechanical engineering option allows the student to pick two approved electives, while for students following Plan II, the general mechanical engineering option allows the student to pick four approved electives.

Master of Engineering Degree

The master of engineering (MEng) degree program is an interdisciplinary degree program that allows students to combine advanced engineering course work with graduate-level non-engineering courses, such as business administration, social sciences, biological sciences or public administration. The requirements for admission are the same as those for the master of science degree. A minimum of 30 semester hours of academic work are required for the MEng degree. At least 15 of these hours must be at the 5000-level or above in mechanical engineering. A maximum of 15 semester hours may be taken outside of engineering. In addition to course work, a written report is required in the MEng program.

Concurrent Bachelor's/Master's Degrees

Students wishing to obtain a BS degree with a major in mechanical engineering and either the MS or the MEng degree in mechanical engineering may do so with up to six semester hours of 5000-level or above courses applying to both degrees. The 5000-level courses must meet the degree requirements for the graduate degree sought and must be suitable technical electives for the BS.

This option is open only for students seeking both degrees at UCDHSC. Students must meet admission requirements to be accepted into the graduate program. Completion of two 5000-level courses does not guarantee admission into the graduate program. Please see an Engineering Student Services advisor for restrictions and guidelines.

PhD Program

The PhD in mechanical engineering is available through the Department of Mechanical Engineering at CU-Boulder. Downtown Denver campus faculty may serve as research advisors by individual arrangement.

Master of Engineering (MEng)

The master of engineering degree program is administered through the departments of engineering. The requirements for admission and for quality and quantity of academic work are essentially the same as for the master of science degree awarded in the College of Engineering and Applied Science.

The principal difference between the master of engineering degree and the master of science degree is that the master of engineering is especially intended to meet the needs of those practicing engineers who wish to follow an integrated, interdisciplinary program of studies in engineering and allied subjects related to the individual student's professional work. Examples of such interdisciplinary programs include engineering and business administration, engineering and environmental sciences, engineering and social sciences, engineering and biological sciences, engineering and behavioral sciences, and engineering and public administration. Appropriate non-engineering course work must be available on the campus where the student attends.

The degree is especially valuable for engineers in industry. It provides a framework for such persons to work toward significant goals fitted to their particular interests. The program can include courses that are made available on videotape or on live television.

Prospective students are required to present a well-defined objective in order to be admitted to the program. In consultation with the faculty advisors, an academic program is developed to meet this objective.

An advisory committee will be appointed for all students by their department. The advisory committee guides the student is responsible for approving the individual's degree program and admission to candidacy, and approves the student's written report and the awarding of the degree.

DEGREE REQUIREMENTS

The requirements for the degree are 30 semester hours, including a written report on a creative investigation that may be related to the student's professional work. The report will be of the same general quality as that required for the master of science thesis and must be defended orally. It may be based upon work done for credit under independent study. At least 15 semester hours must be in engineering at the 5000-level or above. As many as 12 semester hours may be taken outside of engineering at the 4000-level or higher.

Additional information about the degree may be obtained from the College of Engineering and Applied Science and the department offices.