College of Engineering and Applied Science

Engineering Building
(719) 262-3543
Fax: (719) 262-3542
eas.uccs.edu

Engineering is the application of scientific theories and resources of nature for the benefit of humanity.

Computer science provides the essential computational and process control tools for nearly every aspect of modern society. Computer engineering offers a mixture of computer science and electrical engineering. The disciplines of computer science, computer engineering, electrical engineering, and mechanical engineering all require a significant study in mathematics. Graduates of these four disciplines work primarily in technical careers, either public or private, but some also become teachers, managers, or entrepreneurs with their own businesses.

The prospective computer scientist or engineer should appreciate mathematics and have a keen interest in science and its methods. The ability to express ideas in both written and verbal form is of primary importance. The ability to understand problems and produce creative and innovative solutions is also a necessary prerequisite. Personal qualities such as initiative, energy, willingness to take responsibility, reliability, honesty, good judgment, understanding diversity, the ability to work and cooperate with others, and the perseverance to work through to the conclusion of an assignment are important. Obviously, the fundamentals of sound citizenship are necessary in any profession.

Employment demand for computer scientists, computer engineers, electrical engineers, and mechanical engineers is expected to grow faster than the average of all professions well into this century. Abundant opportunities will present themselves to graduates of these disciplines, in both public and private laboratories, in industry, and in commercial enterprises.

Financial rewards to be earned compare favorably with those of other professions; however, no one should enter any profession solely for monetary rewards. Rather, the dominant consideration should be the opportunity to use a lifetime for the advancement of society and the consequent personal satisfactions and enjoyment.

Mission

In partnership with the community and our alumni, the mission of the College of Engineering and Applied Science is to:

- **Illuminate**: Inspiring a passion in our students for life-long learning and graduating engineers and scientists who are knowledgeable and competitive in the global marketplace throughout their careers
- **Investigate**: Conducting recognized and relevant research that has both local and global impact
- **Innovate**: Engaging in leadership, service, economic and technology development that improves health, welfare, and prosperity through engineering.

Academic Advising

Undergraduate

Student Success Center
2nd floor, Main Hall
(719) 262-3260

Or contact the Engineering Academic Advisor at (719) 262-3427

Graduate

Please refer to the appropriate degree program within EAS for information regarding academic advising.

Academic Programs

The undergraduate and graduate programs available for completion through the University of Colorado at Colorado Springs are listed in more detail on the following page.

Majors which may be completed in the College of Engineering and Applied Science at UCCS include Computer Engineering, Computer Science, Electrical Engineering, Innovation, and Mechanical Engineering

Generally, two years of work toward the following degrees from the College of Engineering and Applied Science may be taken on this campus: Architectural Engineering, Chemical Engineering, Civil Engineering, and Engineering Physics

Departments within the College of Engineering and Applied Science (EAS) include the Department of Computer Science (CS), the Department of Electrical and Computer Engineering (ECE), and the Department of Mechanical and Aerospace Engineering (MAE).

Special Programs, Laboratory Facilities and Research Centers

RMTA—Rocky Mountain Technology Alliance

The College of Engineering and Applied Science is the host institution for the local chapter of the Rocky Mountain Technology Alliance (RMTA), which is a regional development organization for applied research and technology development. The membership includes universities, government organizations and private businesses working together to bring forward new technology and manufacturing solutions to support successful commercial growth and national security.

The RMTA cooperatively pursues collaborative programs that will produce intellectual property (IP) for new products and businesses and provide support to existing businesses. The core objectives of the Alliance are to apply technology for the benefit of society, support economic development, strengthen the research base of the region, and foster entrepreneurship.

Programs of Study

Discipline/ Department	Minor	Bachelor of Science	Bachelor of Innovation*	Certificate	Master of Science	Master of Engineering	Doctor of Philosophy**
Aerospace Engineering—MAE	Minor						
Computer Engineering—CS, ECE	Minor	BS					
Computer Science—CS	Minor	BS	BI*		MS		PhD**
Computer Security—CS			BI*	Certificate			
Electrical Engineering—ECE	Minor	BS	BI*		MS		PhD**
Engineering Management—EAS						ME	
Game Design and Development—CS	Minor		BI*				
GMI—CS						ME	
Information Assurance—CS				Certificate	ME		
Mechanical Engineering—MAE		BS			MS		PhD**
Security—CS							PhD**
Software Engineering—CS				Certificate		ME	
Space Operations—MAE						ME (distance only)	
Systems Engineering EAS				Certificate		ME	

***Bachelor of Innovation**—*The Bachelor of Innovation family of programs is an international interdisciplinary undergraduate program between the College of Engineering and Applied Science (EAS) and the College of Business. The Bachelor of Innovation (BI) is a family structure, much like a bachelor of science (BS) or a bachelor of arts (BA), in which particular majors are defined. The BI includes these programs (in alphabetical order): BI in Business and Administration, BI in Computer Science, BI in Computer Science Security, BI in Electrical Engineering, and the BI in Game Design and Development. Each option in the program is composed of an emphasis major, an innovation core, a cross-discipline core, and the general education requirements.*

****Doctor of Philosophy**—*The PhD in Engineering degree has its roots in the successful PhD program in Electrical Engineering offered in the College, and allows a broad range of research areas, including Electrical, Mechanical, and Computer Engineering, as well as Computer Science and Security. A student can also have a PhD program that is interdisciplinary.*

The Alliance works closely with the Dean and faculty of the College to develop first class programs to meet present and future needs of the region.

Computer Science

The Computer Science Department laboratories provide students (of all majors) with access to the latest programs in support of their degrees. The well-equipped laboratories contain a wide variety of computing resources. The Software Development Laboratory contains 27 networked Windows XP Workstations. The Advanced Computing and UNIX Laboratory contains 30 Windows XP and 8 Linux workstations. The Graphics and Networks Laboratory contains several Silicon Graphics workstations and NT/Linux workstations. This laboratory supports research in graphics, computer communications networks and multimedia computing.

Electrical and Computer Engineering

The Electrical and Computer Engineering Department has a wide variety of labs to enhance the learning of undergraduates and graduates in their education and research. With state of the art technology, the students will get hands-on experience in many aspects of the Electrical and Computer Engineering areas. A short description of each lab follows.

The Communications and Signal Processing Laboratory (CSPL)
This lab provides a focus for sponsored and un-sponsored research in communication systems, communication theory, and signal processing. Research projects have included analyses, computer simulation, and hardware experimentation involving spread spectrum communications, space communications, and wireless mobile communications.

The Control-Systems Laboratory (CSL)
The CSL comprises a number of student and research work centers. Each work center has at least one device to control, which includes Educational Control Products (ECP), Magnetic Levitation and Control-Moment Gyroscope systems, and a Rhino Robotics six-degrees-of-freedom robotic arm. Each center has a full complement of test-and-measurement equipment. This laboratory is run jointly with the MAE department.

The Electromagnetics Laboratory (EML)
The EML supports programs in the areas of wave propagation, microwaves, antennas, and metrology. Undergraduate and graduate laboratory courses have been developed in the areas of microwaves, millimeter waves, and infrared (IR) diagnostic techniques to support the existing courses in electromagnetic theory. These laboratory facilities provide students with measurement techniques and skills in the radio frequency (RF), microwave, millimeter wave, and IR wavelength regions. The EML contains a large broadband, shielded microwave anechoic chamber.

The Electronics Laboratory (ECL)
This lab is used for instruction in basic circuits design, digital circuits design, microcomputer systems design, and electronic circuits design. The laboratory is equipped with personal computers, power supplies, function generators, oscilloscopes, logic analyzers, and other components needed to support required laboratories in the Electrical Engineering and Computer Engineering curriculum. This laboratory also houses stations for embedded systems design.

The Microelectronics Research Laboratories (MRL)
These are a group of related laboratories supporting all aspects of microelectronics, including fundamental microelectronic device modeling and processing, integrated circuit design and fabrication. MRL links the efforts of the following associated laboratories: (1) Advanced Development Laboratory (Class 100 clean room), (2) Device Characterization and Analysis Laboratory, (3) VLSI Circuit Design Laboratory, and (4) Advanced Materials Laboratory for undergraduate and graduate students.

Mechanical and Aerospace Engineering
The Mechanical and Aerospace Engineering Department maintains a variety of essential labs for undergraduate and graduate education and research.

Project Lead the Way
UCCS is the Colorado Affiliate University for Project Lead the Way (PLTW), a national pre-engineering curriculum geared for middle and high school students. The College of EAS supports PLTW by providing high school and middle school teacher training and support and by offering graduate continuing education credit for PLTW teachers. The College of EAS also grants college credit for qualified high school students enrolled in PLTW courses from certified high schools. (See detailed information in Undergraduate Transfer Credit.)

EAS General Academic Policies

Advising

Undergraduate
All undergraduate students are required to be advised EACH semester (except summer semester) before enrolling in classes. Students will be advised by their respective departments or the Engineering Academic Advisor. Academic advising is available throughout the year in the Student Success Center, 2nd floor, Main Hall. If you do not know who your advisor is or would like advising, contact the Engineering Academic Advisor at (719) 262-3427, or for appointments, (719)262-3260.

Graduate
Please refer to the appropriate degree program in the *Bulletin* for information regarding academic advising.

EAS Instructional Fees
The College of EAS collects a college-wide EAS instructional fee (EAS IF).

The fee structure for academic year 2008-09 is $15 per EAS credit hour with a maximum of $180 per student per semester. This applies to all courses offered in the College of EAS with the exception of graduate thesis courses. There are no additional fees levied within the College. The fee is nonrefundable.

The purpose of the fee is to assist the College in providing exceptionally high-quality instruction, including but not limited to, the following:

- Support for all instructional labs and smart classrooms managed by the College of EAS
- Support for the College IT network and servers
- College or departmental help centers or instructional supplements provided by students for students, and students run mentoring programs.
- Support for career placement services that are specific to EAS, such as mock interviews with technology companies.

Grading Policies
Consult the General Information section of this *Bulletin* for more information.

Incomplete Courses
An incomplete may be given by the instructor (subject to approval by the appropriate department chair/EAS Dean) for circumstances beyond the student's control, such as a documented medical or personal emergency. When it is given, the student is informed in writing by the instructor of what the student is to do in order to remove the incomplete and when the tasks are to be completed. The instructor may assign only the IF grade. The student is expected to complete the course requirements, e.g. the final examination, term paper, etc, 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 unless the specified work is completed.

No-Credit Courses
Students who register NC (no credit) are expected to attend classes and take all examinations but receive no credit. In the College of Engineering and Applied Science, students may not register NC for a required course, or change registration to NC in any course, except by petition to the chair/dean. If the student does failing work, the chair/dean may request the Office of Admissions and Records to change the registration from NC to credit, whereupon the student will receive a grade of F. A course previously taken for NC may not be retaken for credit to apply toward an undergraduate or graduate degree awarded by the College of Engineering and Applied Science. Engineering courses completed for NC by students not admitted to the College of Engineering and Applied Science may not be taken again for credit after transferring to the college.

Pass/Fail Option
The primary purpose for offering courses in which undergraduates may be graded pass or fail (PF) rather than A, B, C, D, or F is to encourage undergraduate students to broaden their educational experience by electing challenging courses without serious risk that their academic records might be jeopardized. Not more than one course per semester or summer session may be taken PF. Courses which a student may elect to be taken PF shall be designated by the major department. A student who has not designated a major field will not be allowed the PF option. In the College of Engineering and Applied Science only social sciences/humanities courses at the 300 level or above may be taken PF. The maximum number of PF hours counting toward graduation shall not exceed 16 credit hours, including courses taken in the Honors Program under the program's PF grading system. A transfer student may count toward graduation 1 credit hour of PF courses for each 9 credit hours completed in the college.

Graduation Requirements

Bachelor's Degree
To be eligible to graduate with one of the Bachelor's degrees in the College of Engineering and Applied Science, a student must meet the following minimum requirements:

- Be admitted into the degree major at least 30 credit hours prior to graduation
- Have at least a 2.0 CU cumulative GPA for graduation
- Complete the Writing Competency as outlined in the General Information Section of this *Bulletin*
- Satisfactorily complete the MAPS deficiencies before graduation (the requirement is two high school years or two college semesters of a foreign language).
- Satisfactorily complete the prescribed degree curriculum requirements as outlined by the department section later in this *Bulletin*.

It is the responsibility of students to be sure they have fulfilled all the requirements by completing a graduation check in the Engineering Advising office the semester before they anticipate graduating. It is the responsibility of the student to keep the Engineering Academic Advisor informed of any changes in the student's plans throughout the senior year. The department chair must approve deviations from departmental degree requirements, in advance by petition. Petition forms may be obtained at the Engineering Advising office.

Graduate Degrees
Refer to the appropriate College of Engineering and Applied Science degree programs.

Intern/Co-op Programs

The Intern Program assists in the placement of students in part-time positions while they are attending school, and the Co-op Program provides alternate semesters of work and study for students. The purpose of the programs is to allow qualified students an opportunity to supplement their education with work experience in their major area of study. To qualify as an intern/co-op applicant, a student must be enrolled in the College of Engineering and Applied Science and maintain a GPA of at least 2.5. Further information may be obtained by calling (719) 262-3347 or writing to:

Intern/Co-op Program Coordinator
UCCS, College of Engineering and Applied Science
P.O. Box 7150
Colorado Springs, CO 80933-7150

EAS Undergraduate Program Policies

Undergraduate Admission Procedures

The *Bulletin* that governs a student's graduation requirements is the one in effect at the time of a student's most recent admission into the college of the student's degree program.

The college seeks to identify applicants having a high probability of successful completion of their academic programs. Admissions is based on evaluation of many criteria; among the most important are the general level of academic performance before admissions to the college and other evidence of motivation, potential, scholarly ability, and accomplishment by College Board scores, by letters of recommendation from teachers and others qualified to evaluate the student, by accomplishments outside academic work, and by other relevant evidence.

Freshmen
In order to enroll, the student must meet the requirements of the College of Engineering and Applied Science as well as the University requirements described in the General Information section of this *Bulletin*. Students interested in a Bachelor of Science degree who meet these requirements may be admitted into the College.

Placement Requirements:

- Rank in the upper 30th percentile of their high school graduating class
- ACT composite score of 25 or above or an SAT composite score of 1120 or above

Students who meet these requirements are assured admission to the College.

Expected High School Course Work:

- English: 4 course units
- Math: 4 course units; at least two years algebra, one year geometry, one year advanced math
- Natural Science: 3 course units; one year physics, one year chemistry
- Social Science: 2 course units; government, history, economics, psychology, sociology
- Foreign language: 2 course units, all in a single language
- Academic electives: 1 course unit

MAPS

Students should insure that they are taking the Minimum Academic Preparation Standards (MAPS) for Engineering and Applied Science, as outlined in the General Information Section of this *Bulletin*. Beginning students in engineering or computer science must be prepared to start analytic geometry-calculus. (Courses will be offered to allow a student to make up deficiencies; however, no credit toward a degree will be given for algebra or trigonometry.) In order 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.

It is estimated that it will usually take seven semesters to cover this material adequately in high school. Freshman will be given a mathematics placement test during orientation to insure that they begin the correct mathematics course based on their abilities.

Transfer Students

Students transferring from other accredited collegiate institutions will be considered for admission if they meet the requirements outlined in the General Information section of this *Bulletin* or the freshman requirements for entering the College of Engineering and Applied Science. The student should understand that engineering degree requirements differ from one campus to another—from course selection to the number of credit hours required for the degree. To ensure the maximum acceptance of credit toward degree requirements and minimize the length of time required to complete the degree, the student planning to transfer to UCCS should contact the Engineering Advisor (719-262-3427). Please see Web site.

Intra-University Transfer Students

Students from other colleges at UCCS may transfer into the College of Engineering and Applied Science. Students transferring into the College must have completed at least 2 full semesters at UCCS and have a cumulative CU GPA of at least 2.5 (with preference that at least Calculus I is completed). Students with cumulative GPA between 2.0 and 2.5 will require department chair approval before being admitted into their major.

Unclassified Students

Persons who have been admitted to the university in the category of unclassified students may be permitted to register for courses in the College of Engineering and Applied Science upon approval subject to the availability of space in classes. Unclassified students should be aware of the College of Engineering and Applied Science rule that at least the last 30 semester hours must be earned in degree status in the College of Engineering and Applied Science in order to apply toward an engineering degree. A maximum of 12 semester hours of credit earned while in unclassified student status may be carried toward an undergraduate degree at the University of Colorado. High school concurrent students may exceed this 12-hour rule for unclassified students.

Undergraduate Academic Policies

Special Sources of Credit

Advanced Placement

Advanced placement and college credit may be granted on the basis of the College Entrance Examination Board's Advanced Placement Tests or by special examinations administered by the department involved. For students who have taken an advanced placement course in high school and who make scores of 4 or 5 in the CEEB Advanced Placement Test, advanced placement as well as college credit will be granted (outlined in General Information, Advanced Placement Program, in the beginning of this *Bulletin*). Advanced placement credit for the freshman mathematics courses in calculus and differential equations will be limited to not more than 4 hours each.

Project Lead the Way Course Credit

The College of EAS grants college credit for high school students enrolled in Project Lead the Way (PLTW) courses from certified high schools. UCCS is the Colorado Affiliate University for PLTW, a national pre-engineering curriculum geared for middle and high school students. UCCS transcripts credits can be earned for three PLTW courses offered by the EAS College: Principles of Engineering, Introduction to Engineering Design, and Digital Electronics.

High school students must completed the PLTW course, score 80 (based on a scale of 100) or better on the end-of-course college credit exam, and register for the UCCS credit the semester immediately following the high school course.

Up to 5 credits (two courses) are direct course replacements toward a BS degree from UCCS in:

- Computer Engineering (Principles of Engineering & Digital Electronics)
- Electrical Engineering (Principles of Engineering & Digital Electronics)
- Mechanical Engineering (Principles of Engineering & Introduction to Engineering Design)

Additional credits will count as general credits toward a degree from the college. For further information contact the PLTW office at (719) 262-3184.

Transfer Credit Acceptance

Students desiring to transfer credits from engineering technology programs should note that such credits are accepted only upon the submission of evidence that the work involved was fully equivalent to that offered in this college

Some technology courses are given with titles and textbooks identical to those of some engineering courses. These may still not be equivalent to engineering courses because of an emphasis that is nonmathematical or otherwise divergent.

In order to assist engineering technology students with transfer problems, the following guidelines have been established:

- 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 technology students.
- Students who have taken technology courses (courses with technology designations) that may be valid equivalents for engineering courses have these options:
  1. Students may petition the department chair concerned to waive the course. The requirement for a course can be waived if a student demonstrates that by previous course work, individual study, or work experience he/she has acquired the background and training normally provided by the course. No credit is given toward graduation for a waived course, but a strong student may benefit from the waiver by being able to include more advanced work later in his or her curriculum. Other students may profit by taking the course at this college instead and thus establishing a fully sound basis for what follows.
  2. Credit for a course may be given if the course work was done at an accredited institution of higher education. The University of Colorado department involved may recommend that credit be transferred to count toward the requirements for a related course in its curriculum. Credit cannot be given for vocational technical or remedial courses under rules of the University. (See the General Information section on transfer of college-level credit.)
  3. Students may seek credit for the course by examination. See Advanced Placement and College Level (CLEP) Credit.

Transfer Credit Decisions

After a prospective transfer student has made application and submitted transcripts to UCCS, the Office of Admissions and Records issues a computer-generated student transfer credit evaluation, listing those courses that are acceptable by University standards for transfer. Once a student receives the transfer evaluations, an appointment should be made with the Engineering Academic Advisor at (719) 262-3427 to conduct an evaluation of the transfer credits as applicable to a degree in the College of Engineering and Applied Science. If at any time a student wishes to have a course not previously accepted considered again for transfer, the student should consult with the Engineering Academic Advisor.

UCCS has established articulation agreements with all two-year colleges in Colorado. For students from such a college, the transfer process to UCCS will be easier. It is, therefore, beneficial for students from two-year colleges in Colorado to check with their administration to see what courses will transfer.

ROTC Credit

Credit from courses completed in the ROTC program will not apply toward fulfillment of the requirements for degrees in Mechanical Engineering or Electrical Engineering. A maximum of 5 semester hours of work from the ROTC program may be applied toward the BS in Computer Science or Computer Engineering.

Work Experience

It is the policy of the College of Engineering and Applied Science at UCCS that any credits accrued in the official records of the student that were awarded for work experience will not apply as part of the 128 semester hours required for an engineering degree in the College.

Undergraduate Academic Progress

Satisfactory Progress

To remain in good academic standing, undergraduate students must maintain a cumulative CU grade point average of 2.0 or better in hours taken.

Scholastic Suspension

Students whose full-time semester's or cumulative GPA falls below 2.0 will be placed on probation for the next semester in which they are enrolled in the College of Engineering and Applied Science and will be notified by mail. If, after that semester, the semester or cumulative GPA is still below 2.0, the student will be suspended from the college.

Students who have been suspended from the College of Engineering and Applied Science cannot register for courses at the University (except for summer sessions, correspondence courses or extended studies classes) unless the suspension has been lifted or they transfer to another college. Suspended students may apply to transfer to another college within the university and, if approved, take courses in the new major. Students are responsible for knowing whether or not they are under a current suspension.

Students who have been suspended may apply for readmission during the second semester following the suspension (not including summer school) if they meet the following requirements:

- They have brought their cumulative CU GPA up to 2.00 through summer session, and/or correspondence work and/or
- They have satisfactorily completed, at another college or university, a minimum of 15 semester hours of work appropriate to an engineering curriculum.

Suspended students must apply to have their suspension removed (after meeting the above requirements) to the Dean, Engineering and Applied Science. In addition, students may be required to reapply to the University.

Students who are in doubt about their standing with regard to scholastic deficiency are strongly urged to consult with the Engineering Academic Advisor.

Course Load

Full-Time Students and Overload Approval

Students should register for the regular course load as outlined by their advisor. Students may register for 18 hours or less without approval. Permission to take more than 18 semester hours may be granted only after approval, using an Overload Approval Form, submitted to the Engineering Academic Advisor (for 19-21 hours) or the chair of the appropriate department (for over 21 hours). The forms can be obtained from the Student Success Help Center, 2nd floor Main Hall.

Employed Students Course Load Guidelines

Course load guidelines for students employed ten or more hours per week are as follows:

Employed 40 or more hrs/wk (max. 9 sem. hrs.) . . . . 2 courses
Employed 30 to 39 hrs/wk (max. 12 sem. hrs.) . . . . . 3 courses
Employed 20 to 29 hrs/wk (max. 15 sem. hrs.) . . . . . 4 courses
Employed 10 to 19 hrs/wk (max. 18 sem. hrs.) . . . . . 5 courses

The above guidelines result from the experience of those who are both employed and in school. Students who wish to discuss a deviation from these guidelines may call the appropriate department office in the College of Engineering and Applied Science.

Undergraduate Academic Requirements

Common EAS Core

The College of Engineering and Applied Science has implemented a common EAS Core for entering freshmen students. This is a set of courses in English, science, mathematics, the humanities, and social sciences that count towards all undergraduate degrees offered by the College. Though some students declare a major upon acceptance into the College, others may delay the selection of a major. The curriculum of the Common EAS Core provides the students with the necessary foundation for pursuing their education career in the College and at the same time allows a change of major within the College to occur during the freshman year with minimum loss of credit or delay in graduation.

The Common EAS Core makes up 25 of the 32 semester credit hours typically taken by a full time freshman. For the selection of the remainder 7 credit hours, students should consult their college advisors.

The Common EAS Core consists of the following courses:

Math 135 Calculus I 4
Math 136 Calculus II 4
PES 111 General Physics I 4
PES 112 General Physics II 4
English 131 Rhetoric and Writing I 3
Humanities/Social Science Electives 6

Students Planning to Transfer to Another School for Their Degree

The College of Engineering and Applied Science has developed a series of courses at the freshman and sophomore level that meet the requirements for some engineering disciplines at most accredited universities throughout the country. Our advising will follow these generally accepted guidelines. Since curricula will vary slightly from time to time and place to place, students should check with the college/university to which they plan to transfer to verify that the two-year program suggested here would transfer in its entirety.

Engineering and Applied Science Graduate Programs

Master's Degrees

The EAS College offers Master of Science degrees in Computer Science, Electrical, and Mechanical Engineering (refer to corresponding departments for details). The College also offers Master of Engineering degrees in Software Engineering (CS Dept), Media Convergence, Games, and Media Integration Information-GMI (CS Dept), Information Assurance (CS Dept), and Space Operations (MAE Dept), as well as Master of Engineering degrees in Engineering Management and Systems Engineering, which are administered by the EAS College directly. The Space Operations and Systems Engineering programs are distance (online) only.

Admission Procedures—Master's Degree

Every prospective graduate student should consult the graduate student advisor in the respective departments at the College of EAS at UCCS prior to submitting an application for admission to the Graduate School. Students wishing to take graduate courses without formally enrolling as graduate students may enroll in the unclassified student category described in the General Information section of this *Bulletin*.

Guaranteed Early Admissions

Students who are seniors in any of the undergraduate programs in the College of EAS at UCCS may be eligible for guaranteed and simplified admission to the graduate programs. Contact the appropriate graduate degree program director for more details.

Fast Track Admissions Process for Recent Graduates

Students who graduated within the past four years with a degree from the College of EAS at UCCS are eligible for fast track admissions process. Contact the appropriate graduate degree program director for more details.

Regular Admission

Students having an overall undergraduate GPA of 3.0 or better (on a 4.0 scale) in all college-level academic work attempted are normally admitted to regular degree status.

Provisional Admission

See individual programs for details.

General Requirements—Master's Degree

Credit hours: A total of 30 semester hours of graduate course work is required.

Grades: An overall 3.0 grade point average is required in all graduate work.

Thesis or Non-Thesis: The student must select either a Thesis (plan I) or Non-Thesis (plan II) option. Plan I requires a thesis worth from 4 to 6 semester hours of credit. Plan II requires a 3 semester hour project. In both cases, an oral presentation and defense is required, which is open to the public and which can include questions over all work presented for the degree.

Time Limit: All work applied to the degree must be accomplished within a six-year time limit.

Advising: Students are advised by the chair of the graduate studies committee during their first semester. A student must choose an advisor by the time 12 credit hours have been completed.

Plan of Study: All courses included to count for this degree must be part of an approved plan of study. This plan must be developed by the student and approved by his/her advisor (appointed by the department) within the first semester after being admitted to the program.

Doctor of Philosophy in Engineering

The College of EAS offers the PhD in Engineering degree. The degree has its roots in the successful PhD program in Electrical Engineering offered in the College, and allows a broad range of research areas including Electrical, Mechanical, and Computer Engineering, as well as Computer Science and Security. The interdisciplinary nature of this program enables our students to devise programs of study that better suit their interests and needs.

For general information about this program, students are encouraged to contact the College Dean's Office at (719) 262-3543 or by e-mailat dean@eas.uccs.edu.

Students interested in research areas with an emphasis in computer science should directly contact the Department of Computer Science at (719) 262-3544.

Students interested in research areas with an emphasis in electrical engineering should directly contact the Department of Electrical and Computer Engineering at (719) 262-3548

Students interested in research areas with an emphasis in mechanical and aerospace engineering should contact directly, the Department of Mechanical and Aerospace Engineering at (719) 262-3243.

Objectives—PhD, Engineering

- The candidate must have a broad knowledge of science, math and engineering.
- The candidate must have in-depth knowledge of the specific area in which the thesis research will be conducted.
- The candidate must be able to read, understand, and evaluate professional literature on advanced topics in engineering and applied science.
- The candidate must be able to write technical reports and project documentation.
- The candidate must be able to make oral presentations of technical information
- The candidate must demonstrate the capability to make fundamental and significant contributions in the area of engineering and applied science using basic and advanced knowledge of science, mathematics, and engineering disciplines, along with the tools of research, to perform analysis and synthesis and to visualize potential areas of application.

Master of Engineering—Engineering Management (ME EM)

The Master of Engineering—Engineering Management degree is a practice-based graduate degree designed to integrate knowledge and skills from engineering and business disciplines to allow students to develop effective responses to rapidly changing technological and business environments. The program recognizes that many engineers evolve into management and supervisory roles and require a blend of technical advanced engineering and business management education to succeed in today's technical marketplace.

The program prepares engineers for effective participation in management of technology, management of technology-based organizations, and management of technological change. The focus is achieved through a careful balance of graduate course work in business, management, and a technical area of the student's work/academic interests.

ME EM Admission Requirements

The minimum requirements for regular admission into the Master of Engineering—Engineering Management program are as follows:

- Baccalaureate degree (BS) in engineering or a related science discipline from an accredited institution. Students should have a baccalaureate degree consistent with their desired specialization area.
- An undergraduate grade point average of 3.0 or higher on a scale of 4.0 in all college level academic work attempted.
- Evidence of mathematical maturity equivalent to the completion of the following university-level course work:
  - Three semesters of calculus
  - At least one semester beyond calculus (advanced calculus or ordinary differential equations)
  - Linear algebra
  - Probability and statistics
- Experience in a commercial, civil or government engineering/science career field (preferred)

Students are required to obtain two copies of official transcripts from all academic institutions attended (including UCCS if applicable) as well as three letters of recommendation, mailed directly to the EAS College Office.

Applicants who do not meet the requirements for regular admission may be admitted on a provisional basis subject to the recommendations of the Graduate Committee.

Currently enrolled undergraduate engineering students with exceptional academic records may qualify for guaranteed early admission to the graduate program—please contact the College for more information.

ME EM Degree Requirements

ME EM General Requirements
The degree program consists of 30 semester hours of course work comprising 15 hours of core courses and 15 hours of specialization.

Core courses provide the basics of effective business/management education necessary for engineers migrating into management or supervisory roles and establish the conceptual underpinning of the systems engineering process. The specialization courses offer the student the opportunity for graduate course work in a technical discipline of his/her choosing.

Deviations from the predefined curriculum (including requests for transfer credit) must be approved by the graduate faculty advisor and the Graduate Committee and reflected in the Program of Study. Course work must be completed with a 3.0 GPA or better, and all course work applied to the program (including any transfer credit) must have been completed no earlier than six years prior to degree completion.

ME EM Core Requirements (15 required hours)
Students must take the following *three* courses:
BCOM 550 Professional Business Communications
BUAD 560 Business, Government & Society
MAE 5093 Systems Engineering

Student must select *two* courses from the following:
ACCT 600 Contemporary Issues in Accounting
MGMT 600 Leading and Managing in Changing Times
INFS 600 Information Systems
MKTG 600 Marketing Strategy
OPTM 600 Operations: Competing through Capabilities

ME EM Specialization Areas (15 elective hours)
Students will select five Master's level courses associated with a defined specialization area. The courses should be consistent with the student's academic background and professional interests. An academic advisor must approve the course selections.
Current Specialization Areas are:
- Computer Science/Software Systems
- Electrical and Computer Engineering
- Mathematics
- Mechanical Engineering
- Space Systems

Master of Engineering—Systems Engineering (ME SE)

Systems engineering is an interdisciplinary approach encompassing the entire set of scientific, technical, and managerial efforts needed to evolve, verify, field and support an integrated life-cycle balanced set of system solutions that satisfy customer needs. In designing and developing today's large and complex systems, the systems engineer must understand and balance competing demands ranging from the end user's needs to financial concerns.

The systems engineering program first provides a broad understanding of the roles of a systems engineer, and on that foundation it provides a thorough understanding of the implementation process from needs analysis to system requirements. The increasing complexity of today's engineering systems places a great demand on the systems processes and techniques to ensure efficient and cost effective solutions to formulated needs and fielded systems.

ME SE Admission Requirements

The minimum requirements for regular admission into the Master of Engineering—System Engineering program are as follows:
- Bachelor of Science (BS) degree in engineering, mathematics, physics or a closely related field from an accredited institution
- An overall undergraduate grade point average of 3.0 or higher on a scale of 4.0 in all college level academic work attempted
- Evidence of mathematical maturity equivalent to the completion of the following university-level course work:
  - Three semesters of calculus
  - At least one semester beyond calculus (advanced calculus or ordinary differential equations)
  - Linear algebra
  - Probability and statistics
- Two or more years experience with commercial, civil or government systems engineering practice or a closely related field (preferred)

Students are required to obtain two copies of official transcripts from all academic institutions attended (including UCCS if applicable) as well as three letters of recommendation, mailed directly to the EAS College Office.

Applicants who do not meet the requirements for regular admission may be admitted on a provisional basis subject to the recommendations of the Graduate Committee.

Currently enrolled undergraduate engineering students with exceptional academic records may qualify for guaranteed early admission to the graduate program—please contact the College for more information.

ME SE Degree Requirements

ME SE General Requirements
The degree program consists of 30 semester hours of course work comprising 24 hours of prescribed program courses and 6 hours of electives.

The Systems Engineering curriculum included courses designed for working professionals who design, develop, field, operate and maintain today's complex engineering systems. Offered courses stress the system life-cycle approach and the underlying systems engineering process. Other courses offer the quantitative basis for conducting trade studies, computer simulation and risk management. These courses ensure developed systems solutions satisfy the stated need, and are the most cost effective alternative for the fielded system.

ME SE courses are offered in a distance learning (online) format.

Deviations from the predefined curriculum (including requests for transfer credit) must be approved by the graduate faculty advisor and the Graduate Committee and reflected in the Program of Study. Course work must be completed with a 3.0 GPA or better, and all course work applied to the program (including any transfer credit) must have been completed no earlier than six years prior to degree completion.

ME SE Course Requirements (24 hours)
ENGR 501 Introduction to the System Perspective
ENGR 505 Engineering Project Management
ENGR 511 Systems Engineering Process
ENGR 515 System Analysis
ENGR 521 Systems Architecture
ENGR 531 Project Estimation and Risk Analysis
ENGR 535 Engineering Modeling and Simulation
ENGR 545 Systems Engineering Project

ME SE Elective Courses (6 hours)
Students will select two Master's level courses to fulfill the elective requirement. The courses should be consistent with the student's academic background and professional interests and the student's graduate advisor must approve the course selections.

ME SE Capstone Project
All ME SE students are required to accomplish a capstone systems engineering project to demonstrate mastery of the overall program objectives. The project is administered through ENGR 545, which is part of the prescribed course sequence. ENGR 545 is normally scheduled in two parts—a 2 semester hour class during Spring term, followed by a 1 semester hour class during Summer which is devoted to project documentation and final presentation. Project topics are decided between the student and the advisor and will normally reflect a real world industry or community need and/or interest.

Systems Engineering—Certificate Program

The College of Engineering and Applied Science also offers a Certificate in Systems Engineering to qualified students. The program has been designed to provide employees of engineering companies with an opportunity to enhance their systems engineering knowledge and skills. These potential students may not wish to pursue an in-depth rigorous Master of Engineering program but nonetheless desire to increase their professional capability and enhance career advancement opportunities.

For up-to-date information on these programs, please refer to http://eas.uccs.edu/programs.php.

Department of Computer Science

Engineering Building, Room 199
(719) 262-3325 Fax: (719) 262-3369
http://cs.eas.uccs.edu/
E-mail: csinfo@cs.uccs.edu

Faculty

Emeritus: Augusteijn, Badal, Sebesta. ***Professors:*** Boult (El Pomar Chair of Computer Communications and Networking), Chow, Kalita, Semwal and Shub; ***Associate Professors:*** Chamillard, Pinson, and Wiener (Chair); ***Assistant Professor:*** Zhou; ***Instructor:*** Carter.

Programs Coordinated by the Department:

Minor in Computer Engineering
Minor in Computer Science
Game Design and Development Minor
Bachelor of Science in Computer Engineering
Bachelor of Science in Computer Science
Bachelor of Innovation in Computer Science
Bachelor of Innovation in Computer Science Security
Bachelor of Innovation in Game Design and Development
Software Engineering Certificate
Information Assurance Certificate
Secure Software Systems Certificate
Master of Engineering in Games and Media Integration
Master of Engineering in Information Assurance
Master of Engineering in Software Engineering
Master of Science in Computer Science
PhD Program in Engineering, Computer Science Concentration and Security

Computer Science Study

Computer science encompasses a relatively new body of knowledge that treats both theoretical foundations and practical applications of computers. Since the 1950s, significant human, financial, and physical resources have been directed toward the design and development of both less expensive and more powerful computers. These efforts have resulted in a wide variety of computers, ranging from microcomputers costing a few hundred dollars to multi-million dollar parallel processors.

Computer science has applications in virtually every major field, including banking, business administration and management, engineering, applied and pure mathematics, physics, chemistry, biology, word-processing, database management, simulation, numerical analysis, statistics, games, robotics, medicine, animation, automobile and aviation industry, personal communication, and security.

The application of digital computers in all phases of our lives has created many career opportunities. The job market for graduates having a degree in computer science is strong and supported by clear trends for continued growth.

The UCCS curriculum in computer science presented in this *Bulletin* is modern and rigorous. The Department of Computer Science takes great pride in emphasizing quality

teaching supported by modern computer facilities. The UCCS curriculum in computer science also requires a concentration of related courses chosen by the student. This requirement is intended to insure that the graduates of the program will have a base of knowledge embracing a field where computers are applied.

BS Degree

UCCS offers a complete four-year program of study leading to a BS degree in computer science. The undergraduate curriculum provides students with theoretical foundations and practical experience in both hardware and software aspects of computers. The curriculum in computer science is integrated with courses in the sciences and the humanities to offer an education that is broad, yet of sufficient depth and relevance to enhance student employment opportunities upon graduation. As a degree program within a professional school of the university, the curriculum is based on the criterion that graduates are expected to function successfully in a professional employment environment immediately upon graduation.

Joint BS Degree

The Departments of Computer Science and Electrical and Computer Engineering jointly offer a BS Degree in Computer Engineering. This program is described in detail in the Electrical and Computer Engineering section.

Minor Program

UCCS also offers a flexible minor in computer science. The minor provides students the ability to formally supplement their study in other fields with a rigorous computer science background that will enhance employment opportunities after graduation.

General Courses

Students who do not intend to major or minor in computer science may take computer science courses to broaden their backgrounds and complement their degree curricula. Introductory courses CS 100, 103, 104, 105, 106, and 107 are intended to make computer literacy and programming available to a broad class of students. CS115 and 145 are recommended for those who anticipate doing extensive computing in their student or professional careers.

Accreditation

The BSCS degree at UCCS is accredited by the Computing Accreditation Commission of ABET
111 Market Place, Suite 1050
Baltimore, MD 21202-4012
(410) 347-7700.

Bachelor of Science—Computer Science

Objectives

1. **Illuminate**—lifelong learning in computer science:
   a. Alumni will be prepared to learn on their own whatever is required to stay current in their chosen profession, for example, learning new programming languages, algorithms, developmental methodologies, etc.
2. **Investigate**—demonstration of computer science principles:
   a. Alumni should have the ability to find and access information relevant to an application under development.
   b. Alumni should have the ability to model various problem domains and convert them into software solutions.
   c. Alumni should have the ability to apply techniques of algorithm design and automata theory to new problem solving situations.
   d. Alumni should demonstrate the ability to draw upon the expertise of others and negotiate solutions to a problem as a productive technical team member.
   e. Alumni should demonstrate an understanding of the impact of computer problem solutions in a global, economic, environmental, and societal context.
3. **Innovate**—creative application of computer science principles
   a. Alumni should be able to generate new and innovative solutions to solve problems or meet requirements in their discipline.
   b. Alumni should be able to integrate global, economic, environmental, and societal considerations into their problem solutions.

Outcomes

1. An ability to apply mathematical foundations, algorithmic principles, and computer science theory and practice
2. An ability to model, design, implement and test software systems in a way that demonstrates comprehension of the trade-offs involved in design and implementation choices
3. An ability to learn to use new design methodologies, operating systems, languages, and other software development tools within reasonable time constraints
4. An ability to function effectively on teams related to software development
5. An ability to communicate with others, both orally and in writing, about technical subjects
6. An understanding of professional, ethical and social responsibilities
7. Preparation to do continual learning throughout alumni careers, to include such things as pursuing advanced degrees, attending short courses, reading technical or trade journals, participating in sabbaticals, etc.
8. Preparation to pursue careers in all branches of computer science including technical development, project management, and technical sales

Degree Requirements

The bachelor of science degree in Computer Science requires the following:

- completion of at least 128 hours
- a minimum 2.0 average in all CS courses taken, in all CS 400-level (or higher) courses taken, and in all CU courses taken

- completion of the Computer Science Major Field Assessment test. This test will be given on a Saturday morning about three weeks prior to the end of the fall and spring semesters. A student must have completed 110 credit hours before taking the exam.
- CS majors must pass a Programming Proficiency Exam, which is a prerequisite for CS 330 and all 400-level CS courses. This exam is offered every semester and is typically taken after students have completed CS 145.

Course Requirements

The courses for the degree are outlined as follows:

Mathematics (21 semester hours)

MATH 135. Calculus I 4
MATH 136. Calculus II 4
MATH 215. Discrete Mathematics 3
MATH 235. Calculus III 4
MATH 313. Introduction to Linear Algebra 3
MATH 381. Probability and Statistics 3

Science (14 semester hours)

Physics: PES 111, 112, 115 9
Remaining hours selected from classes below 5

CHEM 103, 106; Biology: BIOL 110 and 111 or 115 and 116; GEOL 101 and 101L, 102 or additional physics courses that require PES 111 as a prerequisite.

Computer Science Core (38 semester hours)

CS 115. Principles of Computer Science 3
CS 145. Data Structures and Algorithms 3
CS 206. Programming with C 3
CS 208. Programming in UNIX 2
CS 216. Computer Organization and Assembly Language Programming 3
CS 302 Advanced Object Techology using C++/Net or/and
CS 306. Object-Oriented Programming in C++ 3

All Computer Science majors are required to take either CS 302 or CS 306 as a requirement for graduation. If both courses are taken, one will count as a technical elective.

CS 316. Concepts of Programming Languages 3
CS 330. Software Engineering 3
CS 410. Compiler Design I 3
CS 420. Computer Architecture I 3
CS 450. Operating Systems I 3
CS 470. Computability, Automata,& Formal Languages 3
CS 472. Design and Analysis of Algorithms 3

Computer Science Electives (9 semester hours)

CS 401-489 or 502-599 9

Technical Electives (9 semester hours)

Select from following list:

- Computer Science (300 level or above)
- Electrical and Computer Engineering (2000 level or above, except ECE 2400)
- Mathematics (300 level or above, except MATH 465)
- Science (additional courses from the list above or courses with prerequisites from above list)
- Business (300 level or above, except 301, 302 or 303)

Humanities and Social Science (24 semester hours)

CS 305. 1 credit hour, Social and Ethical Implications of Computing, REQUIRED.

The remaining 23 credit hours involve study in humanities, social sciences, arts, and other disciplines that serve to broaden the background of the student.

Courses in the following departments and programs satisfy this requirement:

- Anthropology (except courses on human biology and ecology), Art History, Communication, Economics, English (150 or above), Film, Foreign Culture Studies, Foreign Languages, History, Humanities, Interdepartmental Studies 101, Music (except university choir and private instruction courses), Philosophy, Political Science, Psychology, Religious Studies, Sociology, and Women's Studies. Students may also petition to include selected other courses in Interdepartmental Studies, Theater, or other departments.

Communications Skills (6 semester hours)

ENGL 131 Rhetoric & Writing I **OR** ENGL 141 Rhetoric & Writing II 3
ENGL 309 Technical Writing and Presentation 3

Free Electives (7 semester hours)

Any course that is a prerequisite course for a required course may not be counted as a free elective. A maximum of 3 credit hours of CS courses numbered less than CS 110 can be used as free electives, provided they are taken prior to a CS course numbered 116 or greater. Six credit hours of 200-level CS courses may be taken as free electives. At most, 3 credit hours of free electives may be taken in a particular programming language. Students planning to later enter a graduate program in computer science or electrical engineering are advised to take at least 6 hours of CS or ECE electives at the 300 or 400 levels. Students who complete their ROTC programs and receive their commissions are allowed up to six semester hours of ROTC course work as free electives toward their computer science degree.

Sample Schedule

Freshman Year

Fall Semester (15 semester hours)

CS 115 Principles of Computer Science 3
Math 135 Calculus I 4
Free Elective or CS110 2
ID 101 or other Humanities/Social Science 3
Engl 131 Rhetoric and Writing I 3

Spring Semester (17 semester hours)

CS 145 Data Structures & Algorithms 3
Math 136 Calculus II 4
CS 206 Programming with C 3
PES 111 General Physics I 4
Humanities/Social Science Elective 3

Sophomore Year

FALL SEMESTER (17 SEMESTER HOURS)

CS 208 Programming in UNIX 2
CS 216 Computer Organization & Assembly Language Programming 3
Math 235 Calculus III 4
PES 112 General Physics II 4
PES 115 General Physics Laboratory I 1
ENGL 309 Technical Writing and Presentation 3

SPRING SEMESTER (17 SEMESTER HOURS)

CS 302 Advanced Object Technolgy Using C++/Net or
CS 306 Object-Oriented Programming Using C++ 3
Free Elective 3
Math 215 Discrete Mathematics 3
Science Elective (Chem 103 recommended) 5
Humanities/Social Science Elective 3

Junior Year

FALL SEMESTER (16 SEMESTER HOURS)

CS 316 Concepts of Program Engineering 3
CS 472 Design and Analysis of Algorithms 3
Technical Elective Course 3
Math 313 Introduction to Linear Algebra 3
Humanities/Social Science Electives 4

SPRING SEMESTER (16 SEMESTER HOURS)

CS 305 Social and Ethical Implication of Computing 1
CS 330 Software Engineering 3
CS 420 Computer Architecture I 3
CS Elective (CS400-599) 3
Math 381 Probability and Statistics 3
Humanities/Social Science Elective 3

Senior Year

FALL SEMESTER (15 SEMESTER HOURS)

CS 450 Operating Systems I 3
CS 470 Computability, Automats, and Formal Languages . . . 3
CS Elective (CS 400-599) 3
Technical Elective 3
Humanities/Social Science Elective 3

SPRING SEMESTER (15 SEMESTER HOURS)

CS 410 Compiler Design 3
CS Elective (CS400-599) 3
Technical Elective Course 3
Humanities/Social Science Elective 4
Free Elective 2
Total Credit Hours 128

Bachelor of Innovation™— Family of Degree Programs

Bachelor of Innovation™ in Computer Science

Please see http://innovation.uccs.edu/BI-details.html.

Bachelor of Innovation™ in Computer Science: Security

Please see http://innovation.uccs.edu/BI-details.html.

Bachelor of Innovation™ Game Design and Development

The Bachelor of Innovation™ in Game Design and Development (GDD) is a new degree within the Bachelor of Innovation family. It is a rigorous technical curriculum based heavily on computer science topics with important cross-disciplinary breadth in art and music. The program as a whole will let students build the foundational knowledge and develop the skills necessary to pursue employment in the games industry. In addition to games for entertainment, this industry includes Serious Games (games designed for simulation and training, educational games, games for healthcare, and so on) and Casual Games (small, short games played in a Web browser or on a cell phone, for example).

The Bachelor of Innovation family requires an innovation core, a cross-disciplinary core, and a set of general education courses in addition to the rigorous technical degree. The combination of the GDD-specific course work and the core Bachelor of Innovation™ topics and experiences will position students to pursue a career at a traditional entertainment game development company; join a company that develops or utilizes Serious Games; form a new small company to develop Casual Games; or use the critical thinking, design, and teaming skills developed throughout the curriculum to pursue employment outside the games industry.

Degree Requirements

The Bachelor of Innovation in Game Design and Development degree requires the following:

- completion of at least 120 credit hours
- a minimum 2.0 grade point average in all computer science courses, GDD courses, and courses taken at the University of Colorado.

Course Requirements

The courses for the degree are as follows:

Innovation Core (27 semester hours)
Cross-discipline Core (21 semester hours)
Creative Communication Core, Business Core, or Globalization Core, outlined as follows:

(*Note: GDD students who select the Business Core or Globalization Core are required to take VA 101, VA 104, and VA 210 as free electives.)*

MATHEMATICS (7 semester hours)

MATH 135 Calculus I. 4
MATH 313 Introduction to Linear Algebra 3

SCIENCE (10 semester hours)

PES 111 General Physics I 4
PES 116 Advanced Physics Lab I 1

ENGLISH (3 semester hours)

Eng 131 Writing and Rhetoric. 3

Remaining hours selected from classes below. 5
Biology, Chemistry, Geography and Environmental Studies, Geology, and Physics and Energy Science.

GDD Core (30 semester hours)

CS 110 Problem Solving through Game Creation 3
CS 302 Advanced OO Techniques using C#/.NET **OR**
CS 306. Object-Oriented Programming in C++. 3
CS 335 Introduction to Game Design and Development 3
CS 478 Advanced 3-D Games and Digital Content Creation . 3
CS 480 Computer Graphics. 3
GDD 120 Introductory Programming for Game Developers. 3
GDD 220 Data Structures for Game Developers. 3
GDD 410 Advanced Game Design Concepts 3
MUS 215 The Computer in Music. 3
WMST 201 Gaming and Society: Gender and Ethnicity. 3

GDD Concentration Requirements (15 semester hours)

Students select 15 hours of concentration courses related to game design and development from the table below. We believe that there will be a significant number of students interested in opportunities for even deeper exploration of GDD topics than undergraduate courses provide; the table below also includes a variety of graduate-level courses that are regularly taken by undergraduates at UCCS.

CS 422 Computer Networks 3
GDD 330 Modeling and Simulation for Games 3
GDD 360 Developing Serious Games 3
GDD 440 Artificial Intelligence for Games 3
GDD 450 Online Game Development 3
GDD 499 Independent Study 3
CS 575 Computational Geometry 3
CS 576 Geometric Modeling. 3
CS 577 Animation and Visualization. 3
CS 579 Wearable Computing and Complex Systems 3
CS 581 Advanced Graphics 3
CS 677 Virtual Reality/HCI 3

Free Electives (7 semester hours)

Students select 7 hours of free elective courses from all the courses offered at UCCS.

The Bachelor of Innovation students are required to participate in research/innovation projects. Most of these will be industry-sponsored projects. Students employed full-time who wish to pursue a degree in this program will be required to sign IP agreements and have such agreements executed by their employer, or arrange for their employer to be one of the industry-sponsored projects.

Sample Schedule

Freshman Year

Fall Semester (15 semester hours)
CS 110 Problem Solving through Game Creation 3
ENGL 131 Rhetoric & Writing I. 3
INOV 101 The Innovation Process 3
MATH 135 Calculus I. 4
Free Elective 2

Spring Semester (14 semester hours)
BUAD 100 Introduction to Entrepreneurship 3
GDD 120 Introductory Programming for Game Developers. 3
PES 111 General Physics I 4
PES 116 General Physics Lab I 1
V A 101 Beginning Studio-2-D. 3

Sophomore Year

Fall Semester (16 semester hours)
BLAW 201 Business and Intellectual Property Law 3
GDD 220 Data Structures for Game Developers. 3
INOV 201 Innovation Team, Reporting & Analysis. 1
LEAD 106 Leadership Communication 3
MUS 215 Computers in Music 3
V A 104 Beginning Drawing. 3

Spring Semester (16 semester hours)
COMM 201 Oral Communication in the Workplace 3
CS 302 Advanced OO Techniques using C#/.NET **OR**
CS 306 Object-Oriented Programming in C++ 3
INOV 202 Innovation Team, Reporting & Analysis. 1
INOV 210 Technical Writing, Proposals and Presentations . . 3
V A 210 Digital Imaging 3
WMST 201 Gaming and Society: Gender and Ethnicity. 3

Junior Year

Fall Semester (16 semester hours)
BUAD 390 Improving Personal and Team Creativity. 3
CS 335 Introduction to Game Design and Development 3
INOV 301 Innovation Team, Reporting & Analysis. 1
MATH 313 Introduction to Linear Algebra. 3
GDD Concentration Course 3
Natural Science Elective 3

Spring Semester (15 semester hours)
CS 480 Computer Graphics. 3
INOV 302 Innovation Team, Design & Research 2
Creative Communication Core course 3
GDD Concentration Course 3
Natural Science Elective 2
Free Elective 2

Senior Year

Fall Semester (14 semester hours)
CS 478 Advanced 3-D Games and Digital Content Creation . 3
GSPA 498 Public Management in Global Context 3
INOV 401 Innovation Team, Design & Research 2
GDD Concentration Course 3
Free Elective 3

Spring Semester (14 semester hours)
BUAD 400 Government, Law, and Society. 3
GDD 410 Advanced Game Design Concepts 3
INOV 402 Innovation Team, Design & Research 2
GDD Concentration Course 3
GDD Concentration Course 3

Minor in Computer Science

General Requirements

- At least 20 credit hours of course work
- Every course in the minor must be completed with a grade of C or better.

The student will be responsible for any prerequisites to required courses. At most, 9 credit hours of transfer work may be applied to the minor.

Course Requirements
CS 145 Data Structures and Algorithms
CS 216 Computer Organization and Assembly Language Programming
CS 206 Programming with C
CS 208 Programming in UNIX

Upper Division (9 hours minimum) selected from CS 300 or above courses

Minor in Game Design and Development

In 2004, computer game industry sales surpassed Hollywood box-office receipts for the first time. Also in 2004, Halo 2 had over $125M in sales on the first day it was available. Gamasutra's job site yields approximately 365 game-related job opportunities posted each month. Computer game design and development is clearly a viable career choice, and the demand for effective game developers is likely to continue experiencing significant growth for the foreseeable future.

Although many nonprogramming game topics are covered in the minor as described here, it does require strong programming skills. We therefore expect students completing the courses for the minor to either come from EAS or, in rare cases, from other colleges.

General Requirements
- 21 credit hours of course work
- All course work toward the minor must be completed with a grade of C or better.

At most 9 credit hours of transfer work may be applied to the minor.

Course Requirements
CS 110 Problem Solving through Game Creation
CS 145 Data Structures and Algorithms
CS 306 Object-Oriented Programming Using C++
CS 335 Introduction to Game Design and Development
CS 436 Game Design and Development Capstone Project
CS 478 Advanced 3-D Games and Digital Contact Creation
CS 480 Computer Graphics
MATH 313 Introduction to Linear Algebra

Computer Science Majors can complete the minor through careful selection of free, CS, and technical electives without increasing the number of credit hours in their program.

Other EAS majors will need to take up to 8 extra credit hours of course work; in some cases, departments will require petitions to count the game design and development courses as technical electives.

Master of Science—Computer Science

The Department of Computer Science offers a program leading to the Master of Science in Computer Science. Courses at the graduate level and the undergraduate courses required for admission to the graduate program are regularly offered in the late afternoon or evening to enable students from local industry to continue their studies.

Admission Requirements
1. An overall undergraduate grade point average of 3.0 on a scale of 4.0. In special cases a student may be admitted with a lower grade point average as a provisional degree student. Students with an average below 3.0 who completed their undergraduate degree a significant number of years ago will also be considered on an individual basis. Students with grade point average deficiencies who take several undergraduate courses to meet entrance background requirements will have their performance in those courses considered in making the admission decision. Students who recently earned an undergraduate degree in computer science with a grade point average below 3.0 may be asked to take the general GRE before they can be considered for admission. The Graduate Studies Committee will make the admissions decision on an individual basis.
2. Four semesters of mathematics courses: two semesters of university calculus, a course in discrete mathematics and one additional course of a mathematical nature.
3. Courses in computer science equivalent to the following courses: Principles of Computer Science (Java or C++), Data Structures and Algorithms, Programming in UNIX, Programming in C, Computer Organization and Assembly Language Programming, Concepts of Programming Languages, and Software Engineering. A student who has completed the requirements for Principles in Computer Science and Data Structures and Algorithms but not the other computer science prerequisites could be admitted, but would still be required to take the unfulfilled prerequisites after admission. Students lacking four or more courses should register as an unclassified student until the courses are completed.
4. Additional requirements may be specified by the Graduate School.

Application forms may be obtained in the Engineering Advising Office and in the Computer Science Office.

Additional Degree Requirements
1. Graduate course work must include CS 550 (Operating Systems I), CS 570 (Computability, Automata, and Formal Languages) and CS 572 (Design and Analysis of Algorithms), if they have not been taken previously.
2. Up to 6 semester hours of graduate courses can be taken from other departments if first approved by the student's MS Advisory Committee.
3. At most four computer science courses may be taken that are cross-listed. Note that the three required courses are cross-listed; if taken, they are counted among the four.
4. After completion of 24 credit hours, a student must be continuously enrolled; a student has a maximum of two years to complete the program.

See also Graduate Degree Requirements for EAS and the Graduate School Requirements.

Outcomes for MS, Computer Science

- The candidate must have a broad knowledge of computer science, covering a variety of fundamental areas (like operating systems, design and analysis of algorithms and theoretical aspects of computability). This broad background can be a result of a combination of undergraduate and graduate course work.
- The candidate must be able to read, understand, and evaluate professional literature in computer science.
- The candidate must be able to write technical reports and software project documentation
- The candidate must be able to make oral presentations of technical information.
- The candidate is expected to have in-depth knowledge of at least one area of computer science, including the topic of the candidate's thesis or project.

Master of Engineering—Software Engineering

Complex software-intensive systems permeate every aspect of our lives. These systems are among the most complex products humankind has ever tackled. Software engineering is the disciplined application of proven principles, techniques, and tools to the creation and maintenance of cost-effective, user friendly software systems that solve real problems.

To accommodate the demand for well educated software engineers in almost all industries today, UCCS has established the Master of Engineering degree in Software Engineering. UCCS offers a unique environment to study, learn, and share experiences surrounding this special engineering discipline. Our faculty comes from a broad spectrum of backgrounds. Many have had years of experience in industry prior to joining the faculty. The result is a diverse melting pot of ideas, technologies, and experiences.

Courses at the graduate level (and the undergraduate courses required for admission to the graduate program) are regularly offered in the late afternoon and evening to enable students from local industry to continue their studies.

Admission Requirements

1. A Bachelor of Science or a Bachelor of Arts degree in mathematics, computer science, engineering, information systems.
2. An overall undergraduate grade point average of 3.0 (on a scale of 4.0; awarded within the past five years) or minimum 1800 GRE (verbal + quantitative + analytic). Applicants with a grade point average of less than 3.0 awarded more than five years ago will be admitted on a case-by-case basis. Applicants with a grade point average between 2.75 and 3.0 awarded within the past five years may be admitted provisionally.
3. It is recommended that the applicant have two years experience with commercial, industrial or government software development or maintenance.
4. A concise statement of experience and career goals.
5. Completed Admission Forms, including two copies of official transcripts and four references sent to the Computer Science Department.

Program Prerequisites

Knowledge of modern programming language, e.g. Java, C++
CS 145 Data Structures and Algorithms
CS 330 Software Engineering Basics

Note: Some of these courses may have prerequisites.

Note: Any comparable course from another approved university will suffice.

Course Requirements

A total of 30 semester hours of graduate course work is required, as follows:

CS 531 Software Requirements Analysis and Specifications
CS 532 Software Design
CS 534 Software Maintenance
CS 535 Software Project Management
CS 536 Software Product Assurance

Plus one of the following options:

1. CS 539 Capstone **OR** CS 701 Project
   Plus four elective graduate computer science courses.
2. CS 700 Thesis (6 credits)
   Plus three elective graduate computer science courses

In either option, a maximum of two cross-listed courses can be applied to the requirements of the degree program.

Additional Graduate Degree Requirements

See also Graduate Degree Requirements for EAS and the Graduate School Requirements.

Master of Engineering Degree in Media Convergence, Games and Media Integration (The GMI Program)

One of the most exciting aspects of the GMI degree program is the combination of a set of required courses that ensure that all students develop a firm foundation in the basics of design and development of games and media integration products, and the opportunity for students to pursue their special interests through several elective courses and portfolio development.

Objectives

Program graduates will demonstrate and be able to perform to professional standards in the following areas:

- A broad understanding of the entire spectrum of media convergence, games and media integration (GMI)
- A thorough understanding of the process of creating, designing, product development and deployment of a game, animation and movie, or a wearable computing product
- Proficiency with many of the tools and techniques for implementing game and media integration product for the industry.

Admission Requirements

1. A Bachelor of Science, Bachelor of Arts, or Bachelor of Fine Arts degree.
2. Considerable computing experience and promise of ability to pursue advanced study and research.
3. An overall undergraduate grade point average of 3.0 on a scale of 4.0. Applicants with a grade point average

of less than 3.0 may be provisionally admitted on a case-by-case basis.
4. Completed Admission Forms, including two copies of official transcripts and three references sent to the Computer Science Department.

Program Prerequisites
The equivalent of the following UCCS courses:
CS 145 Data Structure and Algorithms)
CS 306 OO Programming with C) **OR** CS302 (C#)
MATH 215 Discrete Mathematics
MATH 313 Introduction to Linear Algebra

A student who lacks one or more of the above courses may be admitted, but would still be required to satisfy the above requirement after admission. Students with considerable knowledge of programming and/or mathematical experience in the industry are encouraged to apply.

Degree Requirements
A student will earn a Master's of Engineering degree in Media Convergence, Games and Media Integration consists (GMI) after completing 30 hours of graduate work, as follows:

Required Core Courses (9 credit hours)
The following three courses or their equivalents are required (if they were not previously taken as undergraduate courses):
CS 580 Introduction to Computer Graphics
CS 572 Design and Analysis of Algorithms
CS 578 3-D Games and Digital Contents Creation

Students who have had advanced undergraduate courses in these exact areas will not be allowed to take these courses for graduate credit, but instead are required to include other graduate level computer science courses in their Plan of Study from the list of elective courses.

Required Portfolio (up to 6 credit hours)

GMI students are required to develop an industrial portfolio with an interdisciplinary focus. Through the portfolio, the student shows an ability to completely realize their *individual* contributions, resulting in possibly a high quality exhibit, movie, or game.

The interdisciplinary nature of the GMI program provides all students with extensive knowledge in the widely-varied aspects of Games and Media integration. In turn, this provides students with the chance to integrate technical and artistic ideas in their portfolio. With the portfolio requirement, students carry out a concept to completion: a story would be conceived and then animated; a quest imagined and then fulfilled; or a wearable computing product imagined and implemented, for example.

Suggested applications with strong GMI emphasis areas include but are not limited to the following: applications integrated in TheatreWorks Productions, Digital Animation Movie Production and/or Production of Games, applications coordinating with the Center on Aging, work with visual and performing arts, and disability applications.

The student's portfolio advisory committee will consist of three faculty members, including at least one CS graduate faculty member and, if applicable, one faculty member from LAS. The third member should preferably come from a local industry, representing for example the SigGraph, IGDA community with major portfolio development experience. Dr. Semwal initially would be the CS portfolio advisor.

Completed works are expected to be submitted to SigGraph Animation and Film Festival, International Symposium on Wearable Computing, a variety of virtual reality and HCI interaction conferences, Game Developers Conference, or other related venues around the world.

Thesis or Project (3 to 6 credit hours)
Students are required to complete a project (three credit hours) or a thesis (up to six credit hours). A maximum total of nine credit hours of thesis or project, and portfolio is allowed, ensuring that students have sufficient course work in the games and media integration areas. Students will be expected to work with an advisor in the GMI area of concentration following the guidelines of MS Thesis or Project work in the CS Department.

Elective Courses
The remaining credit hours will be from the following set of 3 credit hour elective courses. Note that some courses have prerequisites as noted. New courses are identified by *.

1. CS 577 Animation and Visualization
2. CS 677 Virtual Reality and Human Computer Interaction
3. CS 571 Evolutionary Computation
4. CS 575 Computational Geometry
5. CS 581 Advanced Computer Graphics/Morphing
6. CS 678 Advanced Digital Effects and Olfactory applications(*)
7. CS 579 Wearable Computing and Complex Systems
8. CS 589 Computational Lingusitics (prerequisites)
9. CS 525 MultiMedia
10. CS526 Advanced Web Systems and Internet
11. CS 584 Computer Vision (prerequisites)
12. CS 505 Computational Computer Vision (prerequisites)
13. ECE 5530 Multivariate control I (prerequisites)
14. ECE 5520 Multivariate Control II (prerequisites)
15. CS 587 Introduction to Artificial Neural Networks
16. CS 551 Distributed Systems (requires CS550—Operating Systems)
17. CS 522 Computer Communication
18. MAE 5130-001 Advanced Fluid Dynamics (prerequisites)

Transfer Credit
Up to 9 hours of graduate work may be transferred from an accredited graduate program, provided:

- Course work has not been used for any other degree.
- Grade earned for the course(s) is B or better.
- The course work has been taken within past six years.
- The course coverage is equal in level, content, and depth to the course for which it is being substituted.

Additional Graduate Degree Requirements
See also Graduate Degree Requirements for EAS and the Graduate School Requirements.

Further Information
Call (719) 262-3544, visit http://eas.uccs.edu/GMI or e-mail prea@eas.uccs.edu, or write the Department of Computer Science.

Master of Engineering—Information Assurance

Network and system security has become very critical and increasingly urgent in today's network and information systems. Information Assurance deals with operations that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and nonrepudiation. The Information Assurance curriculum includes courses designed to prepare individuals who engineer computer/network systems or develop policy for these systems with knowledge of methods, techniques, and tools used in information assurance.

These courses are regularly offered in the late afternoon and evening to provide a more ideal time slot for the working professional.

Our MEIA degree program and curriculum are certified by the National Security Agency's (NSA) Committee on National Security Systems (CNSS and meet the Information Assurance Professional (4011) Training Standards. Successful graduates of the MEIA degree program will receive the CNSS Information Assurance Professional (4011) certificate without additional testing requirements.

Admission Requirements

1. A Bachelor of Science or a Bachelor of Arts degree in mathematics, computer science, engineering information systems, or equivalent.
2. An overall undergraduate grade point average of 3.0 (on a scale of 4.0; awarded within the past five years) or minimum 1800 GRE (verbal + quantitative + analytic). Applicants with a grade point average of less than 3.0 or with degrees awarded greater than five years ago will be admitted on a case-by-case basis. Applicants with a grade point average between 2.75 and 3.0 awarded within the past five years may be admitted provisionally.
3. It is recommended the applicant have two years experience with commercial, industrial or government software development or system/network administration.
4. Completed Application Forms, include two copies of official transcripts, four references, and a concise statement of experience and career goals sent to the Department of Computer Science.

Program Prerequisites
Knowledge of a modern programming language, e.g., Java or C++
CS 145 Data Structures and Algorithms
CS 208 Programming in Unix
CS 216 Computer Organization and Assembly Language Programming

Degree Requirements
Required Core Courses
(15 credit hours, common to both the Thesis option and Non-Thesis option):
CS 520 Computer Architecture
CS 522 Computer Communications
CS 550 Operating Systems I
CS 591 Fundamentals of Computer/Network Security
CS 592 Applied Cryptography for Secure Communications

Degree Completion Courses:
(15 credit hours) Two options are available: Thesis or Non-Thesis.

1. THESIS OPTION:
   a. Complete CS 700 Master Thesis (6 credit hours)
   b. Complete three courses from the approved list of courses. The Graduate Studies Committee must approve the courses selected.

NON-THESIS OPTION:
   a. Complete CS 701 Master Project (3 credit hours)
   b. Complete four courses from the approved list of courses. The Graduate Studies Committee must approve the courses selected.

Transfer Credit

- Up to 9 hours of graduate work may be transferred from an accredited graduate program, provided:
  - The course work has not been used for any other degree.
  - Grade earned for the course(s) is B or better.
  - The course work has been taken within the past six years.
  - The course coverage is equal in level, content, and depth to the course for which it is being substituted.

Additional Graduate Degree Requirements
See also Graduate Degree Requirements for EAS and the Graduate School Requirements.

Certificate in Software Engineering

The College of Engineering and Applied Science offers a Certificate in Software Engineering to qualified students. The program has two purposes: (1) to provide employees of local companies with an opportunity to enhance their software engineering skills and their chances for career advancement, and (2) to provide students currently enrolled in the Master's of Science in Computer Science (MSCS) with more in-depth knowledge in software engineering to enhance employability and career advancement. Please call or write the Department of Computer Science for more information.

Certificate in Information Assurance

The UCCS Computer Science Department offers a set of four graduate courses on campus or onsite through continued education arrangement leading to a certificate in Information Assurance. These courses prepare individuals (who engineer computer-based systems or develop policy and doctrine for systems where information assurance is an objective) with

knowledge of the methods, techniques, and tools used in information assurance.

The four courses are certified by the National Security Agency's (NSA) Committee on National Security Systems (CNSS) and meet the Information Assurance Professional (4011) Training Standards. These courses can count towards the MEIA degree. Successful graduates of the MEIA degree program will receive the CNSS Information Assurance Professional (4011) certificate without additional testing requirements.

Certificate in Secure Software Systems

The UCCS Computer Science Department offers a set of graduate courses on campus or onsite through continuing education arrangements that lead to a Certificate in Secure Software Systems. Students completing the four courses will receive a Graduate Certificate in Secure Software Systems from UCCS. In addition, the courses can constitute 40% of the following programs: Master of Science in Computer Science; Master of Engineering, Information Assurance (MEIA) or Software Systems Engineering (MESSE) options. In addition, the courses can be used in the PhD in Engineering degree program.

Our MEIA degree program and curriculum are certified by the National Security Agency's (NSA) Committee on National Security Systems (CNSS) and meet the Information Assurance Professional (4011) Training Standards. Successful graduates of the MEIA degree program will receive the CNSS Information Assurance Professional (4011) certificate without additional testing requirements.

PhD in Engineering—Concentration in Computer Science, and Concentration in Security

The Department of Computer Science supports the PhD in Engineering program with a concentration in computer science or security. Students who are interested in research areas with an emphasis in computer science or security, and would like to pursue the PhD in Engineering degree should contact the Department at (719) 262-3544.

Department of Electrical and Computer Engineering

Engineering Building, Room 299
(719) 262-3351/3548
Fax: (719) 262-3589
http://eas.uccs.edu/ECE
E-mail: ecedept@eas.uccs.edu

Faculty

Professor Emeritus: Kwor, Norgard, Oleszek and Ziemer; ***Professors:*** Araujo, Ciletti, Dandapani (Associate Dean), Kalkur, (Acting Chair), Sega, Wang, and Wickert; ***Associate Professor:*** Plett; ***Assistant Professors:*** Price and Song; ***Instructor:*** Pauls.

Programs Coordinated by the Department:

Minor in Computer Engineering
Minor in Electrical Engineering
Bachelor of Innovation in Electrical Engineering
Bachelor of Science in Computer Engineering
Bachelor of Science in Electrical Engineering
Master of Science in Electrical Engineering
PhD program in Engineering, Electrical Engineering Concentration

Electrical and Computer Engineering Study

Electrical and computer engineering harnesses the properties of electricity and materials to make possible a variety of devices and systems used for communication, computation, robotic control, navigation, remote sensing, medical imaging, and power generation and transmission.

In today's world, engineers are involved in a host of design activities. They design complex integrated circuits used in computers and communications equipment, as well as the processes that fabricate arrays of transistors in materials such as silicon and gallium arsenide. They develop the control logic that determines how industrial robots operate and they create sophisticated computer programs that allow computers and robots to behave as though they have vision. Electrical engineers play a key role in the design of radar equipment used for navigation in virtually all spacecraft, aircraft, and ships, as well as the brains found in microwave ovens and automobile engines. Some specialize in the engineering of modern, high-speed, digital computers. Many also function effectively in management, marketing and sales efforts of corporations that create technical products. Others pursue advanced studies and participate in the education of other engineers.

The Department of Electrical and Computer Engineering (ECE) offers course work leading to undergraduate (BSEE) and graduate (MSEE and PhD) degrees in electrical engineering and an undergraduate degree in computer engineering. The BS degree in computer engineering (BSCpE) is offered jointly with the Computer Science Department.

Accreditation

The BSEE and BSCpE degrees at UCCS are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Bachelor of Science- Electrical Engineering

Objectives

The educational objectives of the Bachelor of Science degree program in Electrical Engineering are statements that describe the accomplishments of graduates 3-5 years post-graduation:

1. **Illuminate**—lifelong learning in electrical engineering

   Alumni are expected to learn new engineering technologies as needed and pursue graduate school ot technology careers, including but not limited to technical development, project management and technical sales.

2. **Investigate**—demonstration of electrical engineering principles

Alumni should have the ability to find and access information relevant to an application under development and have the ability to understand and approach various engineering problems and convert them into engineering products.

3. **Innovate**—creative application of electrical engineering principles

Alumni should be able to apply the theory and techniques of electrical engineering to innovate real-world solutions.

Outcomes

The Department of Electrical and Computer Engineering has established the following educational outcomes for the Bachelor of Science degree program in Electrical Engineering (BSEE).

By the time of graduation, students are expected to demonstrate:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments as well as to analyze and interpret data
- An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- An ability to function on multi-disciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The acquisition of the broad education necessary to understand the impact of engineering solution in a global, economic, environmental and social context
- A recognition of the need for, and an ability to engage in, lifelong learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Degree Requirements

The Bachelor of Science degree in Electrical Engineering requires the following:

- completion of at least 128 hours
- participation in the Exit Interview
- a minimum 2.0 average in all ECE and CU courses taken
- a minimum 2.0 in ECE 1411, ECE 2610, and ECE 2411.

Course requirements:

Mathematics (18 semester hours)

MATH 135 Calculus I 4
MATH 136 Calculus II 4
MATH 235 Calculus III 4
MATH 340 Introduction to Differential Equations 3
Mathematics Elective (311 or above except 381) 3

Basic Science (16 semester hours)

PES 111 General Physics I 4
PES 112 General Physics II 4
PES 213 General Physics III 3

Select 5 hours from the following list; a lab must be included: CHEM 103-5, CHEM 106-5, BIOL 110-3, BIOL 111-1, BIOL 115-3, BIOL 116-1, GEOL 101-4, GEOL 102-4 or any other PES course that has a prerequisite of PES 111.

Computer Background (6 semester hours)

ECE 1001 Introduction to Robotics **OR**
ID 101 Freshman Seminar: Mindstorms 3
ECE 1021 Computer-Based Modeling & Methods of Engineering 3

Social Sciences and Humanities (15 semester hours)

Studies in the humanities and social sciences serve not only to meet the objectives of a broad education, but also to meet the objectives of the engineering profession. EE students are required to take at least 15 credits of social sciences and humanities so they are more aware of their social responsibilities and better able to consider related factors in the decision-making process. To ensure this, a minimum of nine hours in social sciences and six hours in humanities, or vice versa, must be taken; at least six of these hours must be beyond the introductory level (200 level or higher courses). Breakouts by area are as follows:

Social Science Departments: Anthropology, Communications, Economics, Geography and Environmental Studies, Gerontology, Political Science, Psychology, Sociology, and Women's Studies

Humanities Departments: Art History, Ethnic Studies, English (150 or higher classes), History, Humanities, Music (except choir or lessons), and Philosophy

Communication Skills (6 semester hours)

ENGL 131 Rhetoric & Writing I **OR** ENGL 141 Rhetoric & Writing II 3
ENGL 309 Technical Writing & Presentation 3

Electrical Engineering Core (44 semester hours)

ECE 1411, 2411 Logic Circuits I and II 4
ECE 2050 Introduction to Physical Electronics 3
ECE 2205, 3205 Circuit and Systems I and II 8
ECE 2610 Introduction to Signals and Systems 4
ECE 3020 Semiconductor Devices I 3
ECE 3110 Electromagnetic Fields I 3
ECE 3210, 3220 Electronics I and II 6
ECE 3230 3240. Electronics Laboratory I, II 2
ECE 3420 Microprocessor Systems Laboratory 1
ECE 3430 Introduction to Microcomputer Systems 3
ECE 3610 Engineering Probability & Statistics 3
ECE 4890 Senior Seminar 1
ECE 4899 Design Project 3

Electrical Engineering Technical Elective Requirements (14 semester hours)

Select any four from the following eight three-credit hour Courses: (Students must meet course prerequisites)

ECE 3120 Electromagnetic Fields II
ECE 4020 Semiconductor Devices II
ECE 4242 Advanced Digital Design Methodology
ECE 4340 VLSI Circuit Design I
ECE 4480 Computer Architecture and Design
ECE 4510 Feedback Control Systems
ECE 4625 Communication Systems I
ECE 4650 Modern Digital Signal Processing
ECE 4910 Power Systems II

Total Specified Technical Electives *12*

And, select any two of the following one-credit hour specialty labs: (Students must meet course prerequisites)

ECE 3440 Microcomputer Systems Laboratory
ECE 4040 Introductory VLSI Fabrication Laboratory
ECE 4150 Microwave Measurements Laboratory
ECE 4200 Advanced Digital Design Laboratory
ECE 4530 Control Systems Laboratory
ECE 4560 Digital Control Laboratory
ECE 4670 Communications Laboratory
ECE 4680 Signal Processing Laboratory

Total Specialty Labs *2*

Technical Electives (9 hours)

Technical electives may be chosen from this list: ECE courses at 3xxx or 4xxx level, BIOL300-3, BIOL302-3, BIOL310-3, BIOL314-3, BIOL321-3, BIOL322-3, BIOL330-3, BIOL333-3, BIOL360-3, BIOL361-3, BIOL370-3, BIOL383-3, BIOL391-3, CHEM301-3, CHEM330-3, CHEM331-3, CHEM332-3, CHEM333-3, CHEM334-3, CHEM337-2, CHEM338-2, CHEM340-2, CHEM341-3, PES306-3, PES313-3, PES321-3, PES341-3, PES365-3, PES367-3, CS301-3, CS306-3, CS316-3, CS330-3, MAE3130-3, MAE3135-3, MAE3201-3, MAE3310-3, MAE3401-3, MAE3560-3, MATH311-3, MATH313-3, MATH341-3, MATH350-3, MATH351-3. Other courses in BIOL, CHEM, CS, MAE, MATH and PES numbered 400/4000+ may be accepted with a petition completed prior to taking the course.

Sample Schedule

Freshman Year

FALL SEMESTER (16 SEMESTER HOURS)
MATH 135. Calculus I 4
ENGL 131. Rhetoric and Writing I 3
PES 111. General Physics I 4
ECE 1001. Introduction to Robotics 3
ECE 1411. Logic Circuits I 2

SPRING SEMESTER (16 SEMESTER HOURS)
MATH 136. Calculus II 4
PES 112. General Physics II 4
ECE 1021. Computer-Based Modeling & Methods of Engineering 3
ECE 2411. Logic Circuits II 2
Social Sciences/Humanities Elective 3

Sophomore Year

FALL SEMESTER (16 SEMESTER HOURS)
MATH 235. Calculus III 4
Science Elective with Laboratory 5
ECE 2610. Introduction to Signals and Systems 4
Social Sciences/Humanities Elective 3

SPRING SEMESTER (16 SEMESTER HOURS)
MATH 340. Introduction to Differential Equations 3
PES 213. General Physics III 3
ECE 2050. Introduction to Physical Electronics 3
ECE 2205. Circuits and Systems I 4
ENGL 309. Technical Writing & Presentation 3

Junior Year

FALL SEMESTER (15 SEMESTER HOURS)
ECE 3020 Semiconductor Devices 3
ECE 3205. Circuits and Systems II 4
ECE 3210. Electronics I 3
ECE 3230. Electronics Laboratory I 1
ECE 3420. Microprocessor Systems Laboratory 1
ECE 3430. Introduction to Microcomputer Systems 3

SPRING SEMESTER (17 SEMESTER HOURS)
ECE 3110 Electromagnetic Fields I 3
ECE 3220. Electronics II 3
ECE 3240. Electronics Laboratory II 1
ECE 3610. Engineering Probability & Statistics 3
Technical Electives 4
Social Sciences/Humanities Elective 3

Senior Year

FALL SEMESTER (16 SEMESTER HOURS)
ECE 4890. Senior Seminar 1
Technical Electives 9
Mathematics Elective 3
Social Sciences/Humanities Elective 3

SPRING SEMESTER (16 SEMESTER HOURS)
ECE 4899. Design Project 3
Technical Electives 10
Social Sciences/Humanities Elective 3
Total Hours 128

Minor in Electrical Engineering

General Requirements

The minor in Electrical Engineering requires the following:

- at least 22 credit hours of course work (The student will be responsible for any prerequisites to required courses.)
- every course in the minor must be completed with a grade of C or better.

At most, 9 credit hours of transfer work may be applied to the minor.

Required Courses
Minor courses with associated areas are as follows:

Required Core Courses (10 hours)
ECE 1001 Introduction to Robotics
ECE 1021 Computer Based Modeling & Methods in Engineering
ECE 2610 Introduction to Signals and Systems

Choose one of the following areas:

Computers (14 hours)
ECE 1411 Logic Circuits I
ECE 2411 Logic Circuits II
ECE 3420 Microprocessor Systems Laboratory
ECE 3430 Introduction to Microcomputer Systems
ECE 3440 Microcomputer Systems Laboratory
ECE 4480 Computer Architecture and Design

Electronics (15 hours)
ECE 2050 Introduction to Physical Electronics
ECE 2205 Circuits and Systems 1
ECE 3210 Electronics I
ECE 3220 Electronics II
ECE 3230 Electronics Laboratory I
ECE 3240 Electronics Laboratory II

Electromagnetics (13 hours)
ECE 2205 Circuits and Systems I
ECE 3110 Electromagnetic Fields I
ECE 3120 Electromagnetic Fields II
ECE 4110 Electromagnetic Theory and Applications

Systems (14 hours)
ECE 2205 Circuits and Systems I
ECE 3205 Circuits and Systems II
ECE 3610 Engineering Probability & Statistics

And one of the following:
ECE 4510 Feedback Control Systems
ECE 4625 Communication Systems 1

Bachelor of Science—Computer Engineering

Objectives
The educational objectives of the Bachelor of Science degree program in Computer Engineering are statements that describe the accomplishments of graduates 3-5 years post-graduation:

1. **Illuminate**—lifelong learning in computer engineering

   Alumni are expected to track state-of-the-art technology in computer engineering, to learn new processes, tools and device technologies, and to apply this knowledge in pursuit of graduate work and/or technology careers—including but not limited to technical development, project management and technical sales.

2. **Investigate**—demonstration of computer engineering principles

   Alumni should have the ability to find and access information relevant to an application under development, be able to model various problem domains, and to apply techniques of algorithm, hardware and system design to new problem solutions as a productive technical team member.

3. **Innovate**—creative application of computer engineering principles

   Alumni should be able to apply the general principles of computer engineering to innovative real-world problem solutions that demonstrate consideration for aesthetics, economics, ergonomics, ethics, safety, and sustainability.

Outcomes
The Department of Electrical and Computer Engineering has established the following educational outcomes for the Bachelor of Science degree program in Computer Engineering (BSCpE). By the time of graduation, students are expected to demonstrate:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments as well as to analyze and interpret data
- An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- An ability to function on multi-disciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The acquisition of the broad education necessary to understand the impact of engineering solution in a global, economic, environmental and social context
- A recognition of the need for, and an ability to engage in lifelong learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Degree Requirements
The Bachelor of Science Degree in Computer Engineering requires the following:

- completion of at least 128 hours
- participation in the Exit Interview
- a minimum 2.0 average in all ECE, CS and CU courses taken
- a minimum 2.0 in CS 115, CS 145, ECE 1411, ECE 2411 and ECE 2610.

Course Requirements
Mathematics (18 semester hours)
MATH 135 Calculus I 4
MATH136 Calculus II 4
MATH 215 Discrete Mathematics 3
MATH 235 Calculus III 4
MATH 340 Introduction to Differential Equations 3

Basic Science (14 semester hours)
PES 111. General Physics I 4
PES 112 General Physics II 4
Science 6
Select 6 hours from the following list:
CHEM103-5, CHEM106-5, BIOL110-3, BIOL111-1, BIOL115-3, BIOL116-1, GEOL101-4, GEOL102-4 or any other PES course that has a prerequisite of PES111.

Computer Background (6 semester hours)
ECE 1001 Introduction to Robotics **OR**
ID 101 Freshman Seminar: Mindstorms 3
ECE 1021 Computer-Based Modeling & Methods of Engineering 3

Social Sciences and Humanities (15 semester hours)

Studies in the humanities and social sciences serve not only to meet the objectives of a broad education, but also to meet the objectives of the engineering profession. College of Engineering and Applied Science students are required to take at least 15 credits of social sciences and humanities so they are more aware of their social responsibilities and better able to consider related factors in the decision-making process. To ensure this, a minimum of nine hours in social sciences and six hours in humanities, or vice versa, must be taken; at least six of these hours must be beyond the introductory level (200 level or higher courses).

Breakouts by area are as follows:

Social Science Departments: Anthropology, Communications, Economics, Geography and Environmental Studies, Gerontology, Political Science, Psychology, Sociology, and Women's Studies

Humanities Departments: Art History, Ethnic Studies, English (150 or higher classes), History, Humanities, Music (except choir or lessons), and Philosophy

Communication Skills (6 semester hours)
ENGL 131 Rhetoric and Writing I **OR**
ENGL 141 Rhetoric and Writing II 3
ENGL 309 Technical Writing 3

Computer Engineering Core (Lower Division) (20 semester hours)
ECE 1411 Logic Circuits I 2
ECE 2411 Logic Circuits II 2
ECE 2610 Introduction to Signals and Systems 4
ECE 2205 Circuits and Systems I 4
CS 115 Principles of Computer Science 3
CS 145 Data Structures & Algorithms 3
CS 208 Programming in UNIX 2

Computer Engineering Core (Upper Division) (36 semester hours)
ECE 3210 Electronics I 3
ECE 3420 Microprocessor Laboratory 1
ECE 3430 Introduction to Microcomputer Systems. 3
ECE 3440 Microcomputer Systems Laboratory 1
ECE 3610 Engineering Probability & Statistics 3
ECE 4242 Advanced Digital Design Methodology 3
ECE 4330 Embedded Systems Design 3
ECE 4480 Computer Architecture and Design **OR**
CS 420 Computer Architecture I 3
CS 306 Object-Oriented Programming Using C++ 3
CS 330 Software Engineering 3
CS 450 Operating Systems I 3
CS 472 Design and Analysis of Algorithms 3
ECE 4890 Senior Seminar 1
ECE 4899 Design Project 3

Technical Electives (10 semester hours)
Select at least 10 hours from the following: (Students must meet course prerequisites)
ECE 2050 Introduction to Physical Electronics
ECE 3020 Semiconductor Devices I
ECE 3110 Electromagnetic Fields I
ECE 3120 Electromagnetic Fields II
ECE 3205 Circuits and Systems II
ECE 3220 Electronics II
ECE 3230 Electronics Laboratory I
ECE 3240 Electronics Laboratory II
ECE 4200 Advanced Digital Design Laboratory
ECE 4211 Rapid Prototyping with FPGAs
ECE 4220 Analog IC Design
ECE 4320 Fault Detection & Design for Testability
ECE 4362 Synthesis with Verilog HDL
CS 301 Web Programming
CS 302 Advanced Object Technology Using C++/NET
CS 316 Concepts of Programming Languages
CS 335 Introduction to Game Design and Development
CS 410 Compiler Design I
CS 422 Computer Networks
CS 442 Data Base Systems I
CS 460 Numerical Computing
CS 470 Computability, Automata and Formal Languages
CS 480 Computer Graphics
CS 482 Artificial Intelligence I
MATH 313 Introduction to Linear Algebra

Other courses in CS, ECE, MAE, MATH, and PES numbered 300+ (except MATH301 and 302) may be accepted with a petition completed prior to taking the course.

Free Electives 3

Sample Schedule
Freshman Year
Fall Semester (16 semester hours)
MATH 135 Calculus I 4
ENGL 131 Rhetoric and Writing I 3
ECE 1001 Introduction to Robotics 3
CS 115 Principles of Computer Science 3
Social Sciences/Humanities Course 3

Spring Semester (17 semester hours)
MATH 136 Calculus II 4
PES 111 General Physics I 4
ECE 1021 Computer-Based Modeling & Methods of Engineering 3
CS 145 Data Structures & Algorithms 3
Social Sciences/Humanities Course 3

Sophomore Year

FALL SEMESTER (16 SEMESTER HOURS)
MATH 235 Calculus III 4
PES 112 General Physics II 4
ECE 2610 Introduction to Signals and Systems 4
ECE 1411 Logic Circuits I 2
CS 208 Programming in UNIX 2

SPRING SEMESTER (15 SEMESTER HOURS)
MATH 215 Discrete Mathematics 3
ECE 2205 Circuits & Systems I 4
ECE 2411 Logic Circuits II 2
CS 330 Software Engineering 3
Distribution Course 3

Junior Year

FALL SEMESTER (16 SEMESTER HOURS)
ECE 3210 Electronics I 3
ECE 3420 Microprocessor Systems Laboratory 1
ECE 3430 Introduction to Microcomputer Systems 3
ECE 4242 Advanced Digital Design Methodology 3
CS 306 Object-Oriented Programming Using C++ 3
ENGL 309 Technical Writing 3

SPRING SEMESTER (16 SEMESTER HOURS)
MATH 340 Introduction to Differential Equations 3
ECE 3440 Microcomputer Systems Laboratory 1
ECE 3610 Engineering Probability & Statistics 3
ECE 4480 Computer Architecture and Design or
CS 420 Computer Architecture I 3
CS 472 Design & Analysis of Algorithms 3
Distribution Course 3

Senior Year

FALL SEMESTER (16 SEMESTER HOURS)
ECE 4330 Embedded Systems Design 3
ECE 4890 Senior Seminar 1
CS 450 Operating Systems I 3
Technical Electives 3
Distribution Course 6

SPRING SEMESTER (16 SEMESTER HOURS)
ECE 4899 Design Project 3
Technical Electives 7
Distribution Course 3
Free Elective 3

Total Hours 128

Minor in Computer Engineering

General Requirements

The minor in Computer Engineering requires the following:

- at least 25 credit hours of course work (The student will be responsible for any prerequisites to required courses.)
- a 2.0 minimum is required on all course work.

Course Requirements

Minor courses are as follows:

ECE 1001 Introduction to Robotics
ECE 1021 Computer Based Modeling and Methods in Engineering
ECE 1411 Logic Circuits I
ECE 2411 Logic Circuits II
ECE 3420 Microprocessor Systems Laboratory
ECE 3430 Introduction to Microcomputer Systems
CS 115 Principles of Computer Science
CS 145 Data Structures & Algorithms
CS 208 Programming in UNIX
CS 330 Software Engineering

Bachelor of Innovation™ in Electrical Engineering

Objectives

The Bachelor of Innovation™ in Electrical Engineering will provide students with both the technical and business background to work on innovative electrical engineering-related projects, including the ability to:

- recognize the broader issues in electrical engineering technology-related problems
- understand the technological, business, legal and societal constraints affecting this technology
- communicate the key issues, needs, potential options, and final solution to a challenge

The program seeks to prepare students for successful careers and lifelong learning. In addition to the technical competence to be expected of a graduate with a bachelor's degree in electrical engineering, students will develop the critical thinking skills, multi-faceted team oriented skills and basic business background to ensure that they can effectively compete in the changing technological career landscape for positions that are unlikely to be off-shored.

Degree Requirements

The Bachelor of Innovation degree in Electrical Engineering requires the following:

- completion of at least 128 credit hours
- participation in the Exit Interview
- a minimum 2.0 grade point average in all ECE courses and all courses taken at the University of Colorado
- a minimum 2.0 in ECE 1411, ECE 2205 and ECE 2411

Course Requirements

The courses for the degree are outlined as follows:

Innovation Core (27 credits, 15 of which are HSS)
Business Core (21 credits, 6 of which are HSS) **OR**
Globalization Core (21 credits, all of which are HSS)

Mathematics (18 credits)

MATH 135 Calculus I. . . . 4
MATH 136 Calculus II 4
MATH 235 Calculus III 4
MATH 340 Introduction to Differential Equations 3
ECE 3610 Engineering Probability & Statistics 3

Science (11 credits)
Physics: PES 111, 112, 213 11

English (3 credits)
Eng 131 Writing and Rhetoric I 3

EE Core (39 credits)
ECE 1001 Introduction to Robotics 3
ECE 1411, 2411. Logic Circuits I and II 4
ECE 1021 Computer Based Modeling 3
ECE 2050 Introduction to Physical Electronics 3
ECE 2205, 3205 Circuits and Systems I and II 8
ECE 2610 Introduction to Signals and Systems 4
ECE 3020 Semiconductor Devices I 3
ECE 3110 Electromagnetic Fields I 3
ECE 3210 Electronics I 3
ECE 3230 Electronics Laboratory I 1
ECE 3420 Microprocessor Systems Laboratory 1
ECE 3430 Introduction to Microcomputer Systems 3

Electives (9 credits)
Technical Electives: Select from Electrical and Computer Engineering (3000 level or above) and Computer Science (300 level or above).

Master of Science—Electrical Engineering

The Department of Electrical and Computer Engineering offers course work and thesis supervision leading to the degree Master of Science in Electrical Engineering (MSEE).

Courses at the graduate level are ordinarily taught at 8:00 a.m. or after 4:30 p.m. to enable students from local industry to continue their studies.

Objectives—MSEE

- Be able to read, interpret, and critically assess literature in specialized fields of electrical engineering and to evaluate its impact on current issues on engineering and society.
- Be able to write acceptable technical reports and other documentation.
- Be able to give acceptable oral presentations of a technical nature.
- Be able to apply basic and advanced knowledge in science, mathematics, and engineering disciplines to perform analysis and synthesis of engineering problems.

Admission Requirements

Guaranteed Early Admission

A student who is in his or her final semester studying toward either a BSEE or BSCpE at UCCS is guaranteed admission to the MSEE program if he or she satisfies the following criteria:

1. The student must have completed a minimum of 45 semester hours at UCCS at the time of graduation with the BS degree.
2. The student must be registered in his or her final undergraduate semester (in either the BSEE or BSCpE programs) at the time of application to the MSEE program.
3. The student must have a minimum undergraduate GPA of 3.25.
4. The student must submit a letter of recommendation from the current department chairperson.

Early admission is not available to students who are not residents of the United States of America.

Fast-track Admission

The fast-track admission process is designed to offer a more efficient admission process to former undergraduate students who have graduated from UCCS no more than four years prior to the time of application to a graduate program. A student applying under the fast-track admission rules must submit the following to the Department:

- The Fast-Track Admission application form, accurately and completely filled out
- A completed residency form (back of application form), if the student claims in-state-tuition eligibility
- A check or money order (for the appropriate amount) nonrefundable application fee
- Official transcripts for any university level studies attempted after graduation from UCCS
- A statement giving permission to the ECE graduate program office to obtain an internal transcript from SIS for the applicant. These forms are available from the ECE office, and must be signed by the student
- A letter of recommendation (which may consist of a signed letter from the chairperson of the student's former undergraduate department). Any student with a record that will only allow provisional admission must provide a minimum of two letters of recommendation, using the forms available from the ECE office.

Fast-track admission is only available to graduates of the College of EAS.

Regular Admission

Regular admission to the MSEE program requires the following:

- a 3.0 undergraduate grade point average (GPA)
- The Graduate Record Examinations (GRE) may be required of any student whose GPA falls below this average or is not a graduate of an ABET accredited undergraduate program in electrical engineering. The verbal reasoning and quantitative reasoning portions of the GRE are required of all foreign applicants.

Graduates of foreign universities are required to take the TOEFL exam: A score of 550-600 on the paper-based exam, 79-80 on the Internet-based exam, or 213-250 on the computer-based exam is required.

Note that units completed before admission may not all be transferable into a graduate degree program.

Provisional Admission

Students not admitted on a regular basis may be admitted on a provisional basis depending on their overall application file, including GPA, GRE, letters of recommendation, etc. Students admitted on a provisional basis are often required to take remedial courses (these are specified in the letter of acceptance). Registration for such remedial courses must commence with

the first semester of a student's program with at least three credits completed per semester until all remedial requirements are satisfied.

Application Deadlines
Applications are reviewed on a continual basis, but need to be received by April 1 (fall admission) or October 1 (spring admission) for students who are applying for assistantships. It is recommended that international students apply at least three months prior to the start of the semester to allow time to request a visa.

For more information about these programs, contact the Department of Electrical and Computer Engineering, Graduate Program, Engineering Bldg. Room 299, or call (719) 262-3351. Send e-mailto ecedept@eas.uccs.edu or see our Web page at eas.uccs.edu/ECE.

Duration of Program

The completion of the MSEE degree is normally accomplished in one to three years, and should be accomplished in six years, commencing with the beginning of course work.

A student who is not continuously enrolled (missing three consecutive semesters) becomes inactive and is subject to the rules governing Readmission of Former Students outlined in the Graduate School procedures.

Degree Requirements

Thesis option:

- 30 semester hours total; 24 semester hours of course work; 6 hours of thesis credit.
- At least 18 semester hours must be ECE courses. The remaining 6 semester hours may be replaced by allied department courses (e.g., computer science, mathematics, physics, mechanical and aerospace engineering, etc.).
- At most 6 semester hours may be independent study courses.
- All course work must be numbered 5000 and above if ECE, or 400(0) and above if non-ECE.
- Up to nine semester hours of accepted course work may be transferred from another university or from course work taken as an unclassified student.

Non-Thesis option:

- 30 semester hours total; all 30 semester hours are course work.
- At least 24 semester hours must be ECE courses.
- The remaining 6 semester hours may be replaced by allied department courses (e.g., computer science, mathematics, physics, mechanical and aerospace engineering, etc.).
- At most 6 semester hours may be independent study courses.
- All course work must be numbered 5000 and above if ECE, or 400(0) and above if non-ECE. Up to 9 semester hours of accepted course work may be transferred from another university or from course work taken as an unclassified student.
- There are no additional requirements as to which specific courses a student must take. The student's selection of courses need only meet the above requirements and be approved by the student's academic advisor and the departmental graduate studies committee.
- The non-thesis student must choose an Advisory Committee with the same composition as a Thesis Committee; choose a subject for his/her Master's Report that must be approved by his/her academic advisor; and make an oral presentation and submit a written report to the advisory committee. Both must be approved by the advisory committee.

Grades

The student must have an overall graduate GPA of 3.0 in order to graduate. The student must have a grade of C or better in all courses applied toward the MSEE degree.

Defined Master's Option

The defined MSEE provides options leading toward a MSEE in two years by taking two courses per semester. This program has been designed for graduate students who work full-time. Most courses listed in the defined master's are offered in the evening and will generally be scheduled after 4:30 p.m. See our Web page at http://eas.uccs.edu/ECE for current program options.

PhD Program in Electrical Engineering

The Department of Electrical and Computer Engineering supports a PhD program in Electrical Engineering as part of the PhD in Engineering degree. Students who are interested in research areas in electrical engineering and would like to pursue the PhD in Engineering degree should contact the ECE Department at (719) 262-3351.

Admission Requirements

Regular admission to the PhD program requires the following:

1. A 3.3 grade point average (GPA) on all previous college work, including both graduate and undergraduate.
2. The Graduate Record Examinations (GRE) may be required if the applicant falls below this GPA or is not a graduate of an ABET accredited undergraduate program in electrical engineering. The verbal reasoning and quantitative reasoning portions of the GRE are required of all foreign applicants.
3. Graduates of foreign universities are required to take the TOEFL exam: A score of 550-600 on the paper-based exam, 79-80 on the Internet based exam, or of 213-250 on the computer-based exam is required.

Students not admitted on a regular basis may be admitted on a provisional basis depending on their over-all application file, including GPA, GRE, letters of recommendation, etc.

Students admitted on a provisional basis are often required to take remedial courses (these are specified in the letter of acceptance). Registration for such remedial courses must commence with the first semester of a student's program with at least three credits completed per semester until all remedial requirements are satisfied.

Application Deadlines
To apply, prospective students should contact the ECE Department.

Applications are reviewed on a continual basis, but need to be received by April 1 (fall admission) or October 1 (spring admission) for students who are applying for assistantships. It is recommended that international students apply at least three months prior to the start of the semester to allow time to request a visa. Limited fellowships and assistantships are available.

Degree Requirements
The PhD degree is awarded to students who have satisfied the requirements of duration of program, who have submitted an acceptable dissertation, and who have passed all prescribed examinations.

Requirements for students entering with a master's degree:
- Complete 24 semester hours of course work
- At least 12 semester hours must be ECE courses
- At most 6 semester hours may be independent study courses.
- All 24 semester hours must be numbered 5000 and above if ECE, or 500 and above if non-ECE.

Requirements for students entering without a master's degree:
- Must complete 48 semester hours of course work.
- At least 24 semester hours must be ECE courses.
- At most 12 semester hours may be independent study coursesAll 48 semester hours must be numbered 5000 and above if ECE, or 500 and above if non-ECE.

In all cases: Cross-listed courses which are offered at the 500(0)/600(0) levels must be taken at the 600(0) level.

Requirements for all students:
- Complete 30 semester hours of dissertation research in addition to course work.
- Have an overall graduate GPA of 3.0 in order to graduate.
- Have a grade of B- or better in all courses applied toward the PhD degree.
- Pass the Preliminary Examination, the Comprehensive Examination, and the final Defense of Dissertation.

No foreign language is required.

Research Areas of ECE Department Faculty:
Dr. Carlos A. Paz de Araujo—Microelectronics
Dr. Michael D. Ciletti—Computer-Aided Design, Computer Engineering
Dr. Ramaswami Dandapani—Computer-Aided Design, Computer Engineering
Dr. T.S. Kalkur—Microelectronics, VLSI Circuit Design
Dr. Gregory L. Plett—Adaptive Signal Processing and Control
Dr. Jennifer Price—Communication Theory and Systems
Dr. Ronald M. Sega—Electromagnetics (on leave)
Dr. Hoyoung (Heather) Song—Electromagnetics
Dr. Chia-Jiu (Charlie) Wang—Computer Engineering
Dr. Mark A. Wickert—Communications, Signal Processing

Department of Mechanical and Aerospace Engineering

University Hall, Suite 309
(719) 262-3243
Fax: (719) 262-3042
http://mae.uccs.edu/_
E-mail: mae@uccs.edu

Faculty

Professors: Michael Larson and James Stevens (Chair): ***Professor Emeritus:*** David Schmidt; ***Associate Professors:*** Peter Gorder, Ken Lauderbaugh; ***Assistant Professors:*** Steven Tragesser, Rebecca Webb, Andrew Ketsdever; ***Senior Instructor:*** Julie Albertson.

Programs Coordinated by the Department:

Minor in Aerospace Engineering
Bachelor of Science in Mechanical Engineering
Master of Science in Mechanical Engineering
Master of Engineering in Space Operations (distance only)
Doctor of Philosophy in Engineering

Mechanical Engineering is a core discipline, encompassing mechanics, materials science, thermal science, dynamics and controls, design, and manufacturing. Career opportunities are open to mechanical engineers in industry, government, and universities, as well as in other professions including business, law, and medicine. Mechanical engineers are employed in a wide range of industries including aerospace, automotive, chemical, computing, electronics, industrial machinery, manufacturing, mining, oceanography, petroleum, pharmaceuticals, power, printing, publishing, and textiles. Mechanical engineers usually engage in research, development, design, testing, manufacturing, operations and maintenance, marketing and sales, and administration.

The undergraduate curriculum in mechanical engineering incorporates mathematics, physics and chemistry; humanities/social sciences; business; engineering science; electrical theory; measurement science; mechanical engineering core courses (computer-aided drafting, dynamics and controls, solid and fluid mechanics, thermodynamics, materials science, and heat and mass transfer); and selected technical elective courses. These electives are designed to meet the needs of the industrial, commercial, governmental, and military communities, and to serve students' professional objectives.

Undergraduate students can participate in internship and cooperative educational programs with a variety of high-tech companies along the front-range, which may include Agilent Technologies, B.F. Goodrich, Boeing, Lockheed-Martin, Hewlett-Packard, Quantum, Sturman Industries, SuperFlow Corporation, Transportation Technology Center/AAR, and TRANE.

Undergraduate students also have many opportunities to become involved in discipline-related activities outside the classroom. The MAE Department has active chapters in the American Society of Mechanical Engineers (ASME), the

American Institute of Aeronautics and Astronautics (AIAA), and the Society of Automotive Engineers (SAE).

Further, currently enrolled undergraduate students with exceptional academic records may obtain guaranteed early enrollment in mechanical and aerospace engineering graduate programs.

Bachelor of Science—Mechanical Engineering

Objectives

The Department of Mechanical and Aerospace Engineering has established the following set of program educational objectives for the Bachelor of Science in Mechanical Engineering.

Graduates will be able to use mechanical engineering principles, proficiencies, and technical information to pursue graduate school or engineering careers, including but not limited to design, development, project management, and technical sales.

Graduates will be equipped to pursue continued lifelong growth and development in mechanical engineering, including learning and applying new engineering processes, tools, and technologies.

Graduates will be able to contribute to the state-of-the-art in engineering design, research and problem solving, including consideration of professional responsibilities.

Outcomes

Program outcomes describe what students are expected to know and be able to do by the time of graduation. These are as follows:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments, as well as to analyze and interpret data
- An ability to design a system, component, or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- An ability to function on multi-disciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The acquisition of the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- A recognition of the need for, and an ability to engage in lifelong learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- A knowledge of chemistry and physics
- An ability to apply advanced mathematics
- A familiarity with statistics and linear algebra
- An ability to work professionally in both the thermal and mechanical systems including the design and realization of such systems.

These objectives are regularly reviewed by the constituents of the department's programs, including industrial representatives, students in the program, and the faculty of the department.

These objectives are used to focus the undergraduate degree program and assure the best possible education to our students.

Degree Requirements

The Bachelor of Science degree in Mechanical Engineering requires the following:

- completion of at least 129 credit hours
- completion of an Exit Survey and Interview
- a minimum 2.0 average in all CU courses taken

Required Courses

Communication Skills (6 semester hours)

ENGL 131 Rhetoric & Writing I 3
ENGL 309 Technical Writing and Presentation 3

Humanities and Social Sciences (9 semester hours)

Choose three courses, one must be 200-level or greater.

Courses must be socially and culturally broadening. Acceptable subject matter: Literature, Language, History, Economics, Music, Psychology, Sociology, Political Science, Visual or Performing Arts, Ethnic Studies, Communications, Film Studies, Fine Art History, Music Appreciation, Philosophy, Women's Studies, Professional Writing, or Anthropology.

Basic Science (13 semester hours)

CHEM 103 General Chemistry 5
PES 111 General Physics I 4
PES 112 General Physics II 4

Business (6 semester hours)

Complete two courses from the following list;
ACCT 201 Introduction to Financial Accounting 3
BUAD 100 Survey of Contemp Bus Issues and Concerns . . . 3
ORMG 330 Introduction to Management and Organization 3
MKTG 300 Principles of Marketing 3
MAE 3342 Engineering Economy 3

Mathematics (21 semester hours)

MATH 135, 136, 235 Calculus I, II, III 12
MATH 313 Linear Algebra 3
MATH 340 Introduction to Differential Equations 3
MATH 381 or ECE 3610 Statistics 3

Basic Engineering and Computer Background (3 semester hours)

CS 107 Introduction to Programming in Visual Basic **OR**
CS 115 Principles of Computer Science 3

Mechanical Engineering Core Courses (59 semester hours)

MAE 1503 Introduction to Engineering Design 2
MAE 1502 Principals of Engineering 3
MAE 2055 Mechetronics I. 3
MAE 2101 Statics 3
MAE 2102 Dynamics 3
MAE 2301 Thermodynamics 3
CHEM 301 Materials Science (CHEM 106 prereq. waived) . 3

MAE 3005 Engineering Measurement Lab 3
MAE 3010 Mechanical Engineering Lab 2
MAE 3055 Mechetronics II 3
MAE 3130 Fluid Mechanics 3
MAE 3201 Strength of Materials 3
MAE 3302 Thermodynamics II 3
MAE 3310 Heat and Mass Transfer 3
MAE 3401 Modeling and Simulation of Dynamic Systems . . 3
MAE 3501 Machine Design 3
MAE 4120 Kinematics 3
MAE 4402 Intermediate Dynamics 3
MAE 4421 Feedback Control 3
MAE 4510 Engineering Design I 1

MAE 4511 Engineering Device Design

Technical Electives (12 semester hours)
At least 12 hours of technical courses; all 4 must be 300/3000 or above classes, with at least two being 400/4000 and above classes.

Select from the following Departments: Computer Science, Electrical Engineering, Mathematics, Mechanical and Aerospace Engineering or Physics.

Sample Schedule

Freshman Year

Fall Semester (17 semester hours)
MATH 135 Calculus I 4
ENGL 131 Rhetoric and Writing I 3
PES 111 General Physics I 4
MAE 1502 Principles of Engineering 3
CS 107 Introduction to Programming in Visual Basic 3

Spring Semester (16 semester hours)
MATH 136 Calculus II 4
PES 112 General Physics II 4
MAE 1503 Introduction to Engineering 2
Social Sciences/Humanities Electives 6

Sophomore Year

Fall Semester (18 semester hours)
MAE 2101 Statics 3
MATH 313 Introduction to Linear Algebra 3
MATH 235 Calculus III 4
ENGL 309 Tech Writing & Presentation 3
CHEM 103 General Chemistry I 5

Spring Semester (15 semester hours)
MAE 2102 Dynamics 3
MATH 340 Introduction to Differential Equations 3
MAE 2055 Mechetronics I 3
MAE 2301 Thermodynamics 3
ECE 3610 **OR** MATH 381 Engineering Probability and Statistics 3

Junior Year

Fall Semester (15 semester hours)
CHEM 301 Materials Science 3
MAE 3055 Mechetronics II 3
MAE 3302 Thermodynamics II 3
MAE 3401 Modeling and Simulation 3
MAE 3201 Strength of Materials 3

Spring Semester (15 semester hours)
MAE 3130 Fluid Mechanics 3
MAE 3310 Heat and Mass Transfer 3
MAE 3005 Engineering Measurement Lab 3
MAE 3501 Machine Design 3
Technical Elective 3

Senior Year

Fall Semester (18 semester hours)
MAE 3010 Mechanical Engineering Lab 2
MAE 4402 Intermediate Dynamics 3
MAE 4510 Engineering Design I 1
MAE 4120 Kinematics 3
MAE 4421 Feedback Control 3
Business Elective 3
Technical Elective 3

Spring Semester (15 semester hours)
SS/Humanities Elective 3
Business Elective 3
2 Technical Electives 6
MAE 4511 Engineering Device Design II 3
Total Hours 129

Minor in Aerospace Engineering

General Requirements

The minor in Aerospace Engineering requires the following:

- at least 22 credit hours of course work
- a grade of C or better on each course.

The student will be responsible for any prerequisites to required courses. Only 6 hours of transfer work may be applied to the minor.

Required Courses

Minor courses are as follows:

MAE 4135 Aerodynamics and MAE 4410 Astrodynamics
MAE 3401 Modeling and Simulation of Dynamic Systems
MAE 4420 Feedback Control of Aerospace & Mechanical Systems
MAE 4415 Flight Dynamics
MAE 4510 Engineering Design I with focus on Aerospace Vehicle
MAE 4512 Engineering Design II with focus on Aerospace Vehicle

Select one class from the following list:

MAE 4316 Propulsion
MAE 4318 Airbreathing Propulsion
MAE 4425 Space Environment
MAE 4455 Flight Mechanics
MAE 4460 GPS Principals and Applications

Master of Science—Mechanical Engineering (MSME)

Distance Program Option: Space Operations

The Department of Mechanical and Aerospace Engineering offers a program leading to the Master of Science in Mechanical Engineering (MSME). This research-oriented academic degree is appropriate either as a terminal degree or in preparation for doctoral studies in mechanical and aerospace engineering. Courses at the graduate level are often offered in the late afternoon or evening to enable students from local industry to complete their studies.

The Master of Engineering degree is a practice-based graduate degree. The Master of Engineering program currently offers Space Operations (distance only) for which a series of required courses are specified, leading to a capstone course.

The Master of Engineering degree with an option in Space Operations is ideally suited for working professionals involved in civil, military, or commercial space operations, payload and mission support, space systems analysis, space systems requirements and design specifications. The Master of Engineering in Space Operations is administered and taught as a distance program.

The Graduate Curriculum Includes:

Aerospace Engineering
Automation and Controls Dynamic Systems
Space Systems
Thermal Systems
Fluid Mechanics

Interdisciplinary research programs are available to graduate students. Graduate students can participate in ongoing research programs through independent study projects or as research assistants on sponsored research projects.

See the Graduate Admission Requirements below.

Objectives—MS, Mechanical Engineering

- Prepare the student to perform independent research in their field of specialization
- Provide students with an understanding of the advanced engineering tools and concepts that apply to their field of specialization, with particular emphasis on the mathematical development of those tools
- Prepare the student to pursue doctoral studies in mechanical/aerospace engineering
- Develop student's communication skills and professionalism

Program Prerequisites

- Two semesters of calculus-based physics
- A programming course in a higher order language; linear systems theory; engineering probability; linear algebra; and differential equations are required for admission to the program.

Degree Requirements

The MSME degree requires the following:

- Thirty semester hours of graduate study, with a minimum of six hours of course work in graduate-level pure or applied mathematics.
- Each MSME student may complete the thesis option (Plan I)

During the first semester of enrollment, each student will prepare a Plan of Study, which must be approved by the student's graduate advisor and the MAE Graduate Affairs Committee. The plan will specify the student's selected area of interest and list courses related to that area. Any subsequent changes to the Plan of Study must also be approved by the student's advisor and the MAE Graduate Affairs Committee.

The student and advisor will select an advisory committee, which will provide assistance in formulating and executing the student's graduate program. The committee shall consist of at least three full-time faculty members selected from the College of Engineering and Applied Science at UCCS; the advisor must be a tenured or tenure-track faculty member of the Department of Mechanical and Aerospace Engineering. Eligibility to serve on the graduate committee shall be determined by the policies and procedures of the Graduate School.

Plan I (Thesis Option)

At least twenty-four hours of graduate course work and up to six hours of thesis/research credit is necessary to satisfy the thirty credit hour requirement. The thesis/research credit will be provided for research and preparation of the student's thesis, and defense of the thesis is required for completion of the program. The thesis defense will be based on the thesis and related materials and will be open to the public. Any student who does not pass the thesis defense may attempt the examination a second time. The second failure of the defense will result in dismissal from the MSME program.

Please see the course descriptions for a complete list of graduate courses in mechanical and aerospace engineering.

Admission Requirements

The minimum requirements for regular admission into the MSME or Master of Engineering programs are as follows:

1. Baccalaureate degree (BS) in engineering, applied mathematics, or physics from an accredited institution. Currently enrolled undergraduate engineering students with exceptional academic records may qualify for guaranteed early admission to the MSME graduate program—please contact the MAE department for more information.
2. An undergraduate grade point average of 3.0 or higher on a scale of 4.0 in all college level academic work attempted.
3. Evidence of mathematical maturity equivalent to the completion of the following university-level course work
4. Three semesters of calculus
5. At least one semester beyond calculus (advanced calculus or ordinary differential equations)
6. Linear algebra
7. Probability and statistics
8. Knowledge beyond the introductory level in mechanical engineering, either through prior undergraduate course work and/or professional experience.

9. Two copies of official transcripts from all academic institutions attended, including UCCS itself if applicable.
10. Three letters of recommendation (with at least one from a former instructor), mailed to the MAE Department Office.

Applicants who do not meet these requirements for regular admission may be admitted on a provisional basis subject to the recommendations of the MAE graduate committee.

For more information about these programs and application materials, contact the Department of Mechanical and Aerospace Engineering, Graduate Programs, University Hall, Room 309, or call (719) 262-3243. Send e-mailto mae@uccs.edu or see our Web page at http://eas.uccs.edu/MAE.

Students are encouraged to submit program application materials promptly.

Transfer Credit

Course credit between the CU-Boulder, CU-Denver, and UCCS courses in mechanical or aerospace engineering will be fully transferable. A table of University of Colorado System course equivalencies is contained in the CU-Boulder *Course Catalog*.

Up to nine hours of graduate work may be approved for transfer from other established graduate programs, subject to the following conditions:

- The course has not been used for any other degree.
- The grade earned for each course is B (3.0) or better.
- The course is equivalent in level and content to the course for which it is being substituted.

General Degree Requirements—MSME

- Thirty semester hours of graduate course work.
- A graduate advisor selected in the first semester of the program.
- The course work of ten predefined courses: required "core" courses and additional electives selected from the list approved for that specialization.
- Any deviation from the predefined curricula (including transfer credit) must be approved by a graduate faculty advisor in the MAE Department.
- Course work must be completed with a 3.0 GPA or better
- All course work (including any transfer credit) must have been completed no earlier than six years prior to degree completion.

PhD in Engineering

The Department of Mechanical and Aerospace Engineering supports a PhD program in Mechanical and Aerospace Engineering as part of the PhD in Engineering degree. Students who are interested in research areas in mechanical and aerospace engineering, and would like to pursue the PhD in Engineering degree should contact the Department at (719) 262-3243.

Degree Requirements

The PhD degree is awarded to students who have satisfied the requirements of duration of program, who have submitted an acceptable dissertation, and who have passed all prescribed examinations.

Students entering with a master's degree must:

- Complete 30 semester hours of course work—at least 15 semester hours must be MAE courses, at most 9 semester hours may be independent study courses.
- All 30 semester hours must be numbered 500(0) and above.
- Cross-listed courses which are offered at the 500(0)/600(0) levels must be taken at the 600(0) level.
- Complete 30 semester hours of dissertation research in addition to course work.
- Have an overall graduate GPA of 3.0 in order to graduate.
- Have a grade of B- or better in all courses applied toward the PhD degree.
- Pass Preliminary Examination, Comprehensive Examination

No foreign language is required.