
Courses are offered in astronomy, engineering graphics, and environmental science and policy to provide electives for students in other areas.

Degrees offered are the Master of Engineering, Master of Science and Doctor of Philosophy. The MS and PhD programs serve primarily full-time graduate students. Industrial residency programs leading to the Master of Science degree are available in certain engineering departments. Financial aid, in the form of full and partial fellowships and teaching and research assistantships, is available. Other financial aid packages are available to outstanding applicants. A broad and vigorous research program provides excellent opportunities for thesis and dissertation research.

The Master of Engineering program is open to individuals who are interested in professionally oriented graduate study. Requirements for the program are a baccalaureate degree from an ABET-accredited engineering program or equivalent, academic and professional records which indicate motivation for and the ability to complete additional professional study and acceptance by the chair of the department in which the individual plans to major and by the Dean of the College of Engineering and Science.

Graduate engineering education opportunities for practicing engineers are available in two disciplines. The Department of Electrical and Computer Engineering offers off-campus graduate courses leading to the Master of Engineering degree through satellite broadcasts, Internet and DVD. The Department of Mechanical Engineering offers selected off-campus graduate courses at the University Center of Greenville. Furthermore, graduate courses in both disciplines are offered on-campus during the late afternoon/early evening once a week.

**AUTOMOTIVE ENGINEERING**

**Master of Science**

**Doctor of Philosophy**

The Master of Science and Doctor of Philosophy degrees in Automotive Engineering prepare a new generation of engineers to deal with the complex technological, environmental and globalization issues facing the automobile industry.

The big challenge facing the industry is the integration of diverse technologies in the automobile and its cost effective and environmentally responsible manufacture, all being done in a global network with people of different backgrounds and cultures. The Automotive Engineering programs equip students with the basis, depth and domain knowledge needed for master's and doctoral-level expertise in systems integration and vehicle systems engineering and the ability to work globally. Graduates of the program are able to lead teams of culturally diverse individuals to produce an integrated automobile platform or to work in research laboratories involved with the design of new products in the automotive field. While the program is geared toward the automobile industry, it produces strong linkages with the aerospace and other industries within the state, region and nation as some of the challenges faced by the automotive industry are also faced in other sectors.

**Master of Science**

Admission to the MS program occurs in the fall semester only. Students are required to hold a BS degree from a recognized relevant engineering or science discipline and the equivalent of two years of postbaccalaureate full-time work experience in industry. Students have the opportunity to tailor the program either in the functional aspects or systems aspects of automotive engineering through appropriate course choices.

The program is divided into four content areas, consisting of 36 credit hours of coursework and six hours of project work, as follows:

- Core Courses—AU E 880, 881, 882, 883
- Automotive Engineering Track—18 credit hours in two or three track areas with nine hours in automotive engineering courses and nine hours based on the student’s interests and specialization.
- Business or Related Field—a minimum of six hours in a concentration area or minor approved by the advisory committee
- Internship—a six-credit-hour internship of six months duration in an industrial setting
- Foreign language proficiency is required as an outcome of the program.

**Doctor of Philosophy**

Students are admitted into the PhD program in the fall, spring and summer terms. Minimum admission requirements include a bachelor’s or master’s degree in a recognized relevant engineering or science discipline. Students entering the program directly with a BS degree must meet the entrance requirements for the MS degree and have a grade-point ratio of 3.5 or higher in their undergraduate programs. Students with an MS degree in a recognized relevant engineering or science discipline are not subject to the two years of postbaccalaureate full-time industrial experience requirement.

Program requirements are as follows:

- Core Courses—AU E 880, 881, 882
- Automotive Engineering Track—minimum of six hours (two AU E courses from two track areas)
- Discipline-Specific Courses—no minimum requirements, typically five additional courses
- Business or Related Field—minimum of three hours in a directed, nontechnical field
- Technical Courses—minimum of nine hours in a concentration area outside the discipline or a technical minor
- Dissertation—18 credit hours
- Foreign Residency Requirement—six-month residency at a foreign research laboratory or university

**BIOENGINEERING**

**Master of Science**

**Doctor of Philosophy**

Bioengineering is the application of engineering and scientific principles to understand and solve medical problems. As medical technology has rapidly developed over the past four decades, the demand for qualified bioengineers has dramatically increased. Career opportunities for bioengineers range from teaching and conducting basic research in academia to research and development work in the growing medical product industry. Employment opportunities are also available in independent research laboratories, hospitals and federal agencies such as the Food and Drug Administration or the National Institutes of Health.

Clemson University’s Bioengineering program is one of the oldest in the world; its PhD program began in 1963 and its MS program was added in 1966. Historically the department is widely recognized to have pioneered the field of biomaterials. Today the Department of Bioengineering maintains its focus on biomaterials and related areas, including tissue engineering, regenerative medicine, drug delivery, biomechanics and biosensors. Although Clemson University does not have a medical school, the Bioengineering Department maintains close collaborative ties with several medical centers in the Carolinas. In particular, Clemson has a formal partnership with the Medical University of South Carolina, located in Charleston, and maintains full-time bioengineering faculty and students at both campuses. Interactions between the two institutions are facilitated by state-of-the-art videoconferencing facilities, which
enable students to take classes and interact directly with faculty at either location. A joint MD/PhD program is provided for qualified students as part of this partnership.

Applicants to the Bioengineering programs typically hold a Bachelor of Science degree in engineering, science, or life science. Students with nonengineering backgrounds may be required to take remedial courses in engineering (e.g., materials science, statics and mechanics, and calculus through differential equations) in addition to their regular bioengineering curriculum, which may be taken either before or after enrollment.

The Department offers a Master of Science and a Doctor of Philosophy degree. The curriculum for the MS degree consists of a core of recommended bioengineering courses supplemented by elective courses that provide the student greater depth in a specific area of interest. Two degree options are offered at the master’s degree level: a thesis and a nonthesis option. The thesis option requires a total of 30 credit hours (six of which must be research credits) and the submission and defense of a master’s thesis. The nonthesis option requires a minimum of 33 credit hours (six of which must be research credits) followed by the submission and oral presentation of a publishable-quality report on an approved topic. The minimum time necessary to complete the master’s degree is normally 16 months, out of which at least one academic semester must be undertaken in residence as a full-time student at Clemson University.

Students interested in obtaining a doctoral degree are encouraged to apply directly to the PhD program from their BS degree program, with the PhD program typically requiring about five years to complete following the BS degree or about four years following the MS degree. The selection of courses for the doctoral degree is flexible and depends on the background and objectives of each candidate. A typical program includes 12 or more credit hours of graduate-level courses beyond the MS degree requirements. Candidates for the PhD degree must provide evidence of their potential success in advanced graduate study. This is demonstrated by passing both the qualifying and comprehensive examinations, which are usually taken after the first year of graduate school. The qualifying examination consists of a detailed written report and an oral presentation on the background and the state-of-the-art concepts and theories pertinent to the student’s intended area of doctoral research and an oral examination of the student’s understanding of these topics. The comprehensive examination involves the oral presentation and defense of the student’s proposed original research plan before his/her selected research committee and is typically taken within a year of passing the qualification exam. The PhD program culminates with the presentation and successful defense of a doctoral dissertation, which is scheduled following the completion of the student’s approved research plan.

**Combined BS/MS in Biosystems Engineering**

Under this plan, students may reduce the time necessary to earn both BS and MS degrees by applying graduate credits to both undergraduate and graduate program requirements. Students are encouraged to obtain the specific requirements for the dual degree from the Department of Biosystems Engineering as early as possible in their undergraduate program. Enrollment guidelines and procedures can be found in the Undergraduate Announcements.

**BIOSYSTEMS ENGINEERING**

**Master of Science**

**Doctor of Philosophy**

The Biosystems Engineering program prepares individuals for leadership, creative accomplishment, continued professional learning and independent research. Students may be accepted with backgrounds in any branch of engineering or quantitative-based scientific fields relating to chemistry, mathematics, physics, or biology. Undergraduate prerequisite or corequisite courses may be required for applicants with undergraduate degrees in nonengineering disciplines.

Acceptance is determined by departmental faculty review based on records of academic achievements (including grades from previous programs and GRE scores) and other appropriate professional accomplishments.

Each degree program is planned individually to augment the student’s previous engineering and science background with adequate breadth in engineering and specialization in an area of biosystems engineering. Coursework includes biosystems and related engineering, mathematics, physics, chemistry, statistics, and biological, environmental and engineering sciences.

Candidates for the MS degree are required to complete a minimum of 24 credit hours of coursework plus an additional six hours of thesis research and complete an acceptable thesis. Candidates for the PhD degree are required to complete additional hours of coursework beyond the MS degree at the discretion of the graduate committee, typically 30–36 additional credits. Completion of 18 hours of dissertation research and the submission of an acceptable dissertation are also required.

**CHEMICAL ENGINEERING**

**Master of Science**

**Doctor of Philosophy**

The Department of Chemical Engineering and Biomolecular Engineering offers programs leading to the Doctor of Philosophy and the Master of Science degrees. Graduate programs at Clemson prepare students to apply science and engineering principles to complex problems associated with the chemical, biomolecular and associated industries. Students develop a rigorous fundamental science base coupled with insight into engineering applications. Graduates become involved in the design, manufacture and use of chemicals, polymers, pharmaceuticals, electronic components, consumer products and petroleum products, to name a few. The department has strong research programs in advanced materials, biotechnology, energy, and chemical and biochemical processing.

Although most graduate students have a BS in Chemical Engineering, students with backgrounds in chemistry, physics, or other branches of engineering are encouraged to apply and will be considered fully for admission. To facilitate a transition from BS degrees other than Chemical Engineering, special programs are available. Students can enter the PhD program in Chemical Engineering directly after completion of a BS degree.

The MS degree program consists of 30 credit hours, including six credit hours of research. Coursework includes CH E 803, 804, and 805. In addition, six hours of approved chemical engineering electives and nine hours of approved technical electives are required. At least six of these 15 elective hours must be selected from courses numbered 800 or above. MS degree candidates must complete a thesis.

The PhD program consists of 36 credit hours of approved graduate courses beyond the BS degree, including 12 credit hours of approved graduate courses at Clemson. Admission to candidacy for the PhD degree requires completion of written and oral qualifying examinations. Doctoral students must satisfy the MS course requirements through courses taken at Clemson University or elsewhere. Each doctoral student must complete at least six credit hours of approved graduate courses offered by departments other than Chemical Engineering. In addition, each student is required to complete 30 credit hours of graduate research, including 18 doctoral dissertation research credit hours (CH E 991) taken at Clemson University. The PhD program concludes with the completion and defense of a doctoral dissertation.

Minors for doctoral students may be taken in chemistry, physics, mathematics, life sciences, or other branches of engineering.
CHEMISTRY
Master of Science
Doctor of Philosophy

Degree concentrations are offered in analytical, inorganic, organic, physical chemistry and chemistry education. Research areas also include bio-organic chemistry, polymer chemistry, materials chemistry, chemical physics and other areas. A PhD degree in Chemistry with a concentration in textile chemistry is offered jointly with the School of Materials Science and Engineering.

MS degree candidates must complete 24 hours of coursework and six hours of research culminating in a satisfactory thesis.

The primary requirement for the PhD degree is the performance of original research leading to a dissertation. PhD degree candidates must qualify to pursue the degree by completing a flexible curriculum of coursework designed to demonstrate broad chemical awareness, a distribution requirement and a focus area requirement. Some coursework requirements may also be satisfied by examination. Students must complete 18 graduate credits in their first year of study and must have a GPR of 2.90 or better by the end of their third semester.

Admission to candidacy for the PhD degree requires completion of a comprehensive examination in the area of concentration. This exam takes the form of a written cumulative exam, followed by an oral presentation before a faculty committee.

CIVIL ENGINEERING
Master of Science
Doctor of Philosophy

The Master of Science degree program is open to all individuals who have a four-year baccalaureate degree. A degree in engineering is not required for admission, but most entering students have an undergraduate Civil Engineering degree.

There are two options available for students pursuing a Master of Science degree. The student may prepare a research thesis or may take additional courses in lieu of completing a thesis.

The thesis option requires the preparation of a research thesis that is a part of the total credit hours required for the degree. Students intending to pursue a doctoral degree usually choose the thesis option. Completion of a research thesis is excellent preparation for the research necessary for a doctorate if a student is inclined to pursue that degree in the future.

The nonthesis option does not require the preparation of a research thesis but does require completion of additional coursework. This degree option provides the student with additional directed study through coursework. Normally students pursuing the nonthesis option will not pursue a doctorate.

Except for the core courses required by different disciplines, there are no formal course requirements for students pursuing a Master of Science degree. The program normally contains some engineering design and a minimum of ten credits of engineering science, advanced mathematics and basic science. In addition, each student in the thesis option must complete an advanced research project. The final program of study must contain at least 30 hours of graduate credit including the core curriculum requirements. Of these 30 credits, no more than six hours may be thesis research (C E 891) for those students pursuing the thesis option. At least half of the remaining hours must be from courses numbered 800 or above.

The final examination for the MS nonthesis option is an oral or written exam (or a combination of the two) consisting of questions related to fundamental knowledge in a student’s chosen area of concentration (i.e., applied fluid mechanics, construction materials, geotechnical engineering, project management, structural engineering, or transportation systems).

The final examination for the MS thesis option is an oral exam consisting of a student’s MS thesis defense and questions related to fundamental knowledge in a student’s chosen area of concentration (i.e., applied fluid mechanics, construction materials, geotechnical engineering, project management, structural engineering, or transportation systems).

Dissertation Defense—As required by the Graduate School, the candidate for the Doctor of Philosophy degree must pass a final oral examination (dissertation defense). The examination consists of a presentation of the student’s doctoral research and an assessment by the committee of the research approach, the significance of the findings and the contribution to the advancement of civil engineering.

Combined BS/MS in Civil Engineering

Civil Engineering undergraduates at Clemson may begin a Master of Science degree program while completing the Bachelor of Science degree and use a limited number of courses to satisfy the requirements of both their undergraduate and graduate degrees. The following requirements apply:

1. Undergraduate students must have a minimum cumulative grade-point ratio of 3.4 and must have completed the junior year prior to taking graduate courses. Students are required to maintain this minimum grade-point ratio to continue enrollment in a combined degree program.

2. Graduate Record Examination (GRE) scores are not required to be submitted as part of their Graduate School application; however, applicants are encouraged to submit GRE scores to receive full consideration for graduate fellowships and assistantships upon completion of the BS degree.

3. Up to six semester hours from any 600- or 800-level civil engineering courses may be used to satisfy the requirements of the BS degree. These courses may be counted as technical requirements or electives. Undergraduate students are required to have selected one of their technical requirements from the area of transportation systems, geotechnical engineering, or environmental engineering.
4. Since approval of the graduate program of study is required by the student’s graduate advisory committee, students should consult with their academic advisors before selecting courses to be included in the graduate program.

5. Students in a combined degree program are conditionally accepted to the graduate program until completion of the BS degree requirements. Students are not eligible for graduate assistantships until full acceptance is granted.

Students interested in this combined degree program should consult the Civil Engineering Graduate Program Coordinator, the undergraduate advisor and the Civil Engineering Honors Coordinator (if applicable). Students pursuing an optional emphasis area in their undergraduate degree program may substitute 600-level courses for any 400-level counterpart taken to meet the requirements of an emphasis area. Application for this program should be made by the end of the junior year, but no later than one semester prior to expected BS graduation. Application details are available in the Undergraduate Announcements.

**COMPUTER ENGINEERING**

**Master of Science**

**Doctor of Philosophy**

The Computer Engineering program is a combination of computer software, hardware, systems and applications. Areas of specialization include computer systems architecture, communication networks, digital signal processing and intelligent systems. Enrollment is open to graduates in any branch of engineering, computer science, or applied mathematics who have an appropriate engineering and/or science background.

For the MS program, students may write a thesis or follow a nonthesis option. The thesis option requires a total of 30 credit hours including six hours of thesis research. For the nonthesis option, 33 credit hours of coursework must be completed.

The PhD degree requires at least 24 credit hours of graduate coursework beyond the master’s degree and 18 research credit hours. Specially qualified candidates with a BS degree may apply for direct entry to the PhD program in any of the above areas. The program of study and hours required beyond the baccalaureate degree are specified by the focus area but must be at least 60 hours including coursework and research credit.

Detailed information is available at www.clemson.edu/ces/department/ece.

**COMPUTER SCIENCE**

**Master of Science**

**Doctor of Philosophy**

To receive full admission to graduate study in computer science, a student must have taken intermediate-level undergraduate computer science, including computer organization, data structures, operating systems, either algorithms or theory of computation, and either compilers or survey of programming languages; and basic mathematics including discrete mathematics. An applicant with minimal deficiencies may be admitted with prerequisites, while one with several deficiencies may be required to satisfactorily complete prerequisite work as a non-degree student prior to admission as a graduate student.

A candidate for the MS degree must satisfactorily complete an approved program of at least 30 graduate hours. Students may elect one of two options to satisfy the degree requirements: a coursework-only option or a thesis option. The thesis option requires six hours of research credit as part of the 30-hour requirement. Students may take up to six hours of approved courses in areas outside the department.

Although formal course requirements for the PhD degree are minimal, a typical program requires two to four years of study beyond the MS degree. Each candidate is required to pass a comprehensive examination, a dissertation proposal and a defense of the dissertation.

**Combined BS/MS in Computer Science**

Computer science undergraduates may begin a Master of Science degree program while completing the Bachelor of Science degree and use a limited number of courses to satisfy the requirements of both their undergraduate and graduate degrees. The following requirements apply:

1. Undergraduate students must have a minimum cumulative grade-point ratio of 3.4 and must have completed the junior year prior to taking graduate courses. Students are required to maintain this minimum grade-point ratio to continue enrollment in a combined degree program.

2. Graduate Record Examination (GRE) scores are not required to be submitted as part of the Graduate School application; however, applicants are encouraged to submit GRE scores to receive full consideration for graduate fellowships and assistantships upon completion of the BS degree.

3. Students in a combined degree program are conditionally accepted to the graduate program until completion of the BS requirements. Students with this conditional acceptance are not eligible for a graduate assistantship until the conditional acceptance is removed.

4. Up to nine semester hours from any 600- or 800-level computer science courses may be used to satisfy the requirements of the BS degree.

5. Graduate courses taken as an undergraduate may be included in the graduate program of study; however, any 600-level course that has a corresponding required 400-level counterpart in the BS or BA in Computer Science or the BS in Computer Information Systems may not be counted toward the MS degree. Since approval of the graduate program of study is required by the student’s graduate advisory committee, students should consult their academic advisors before selecting courses to be included in the graduate program.

Students interested in this combined degree program should discuss it with the Computer Science graduate program coordinator and undergraduate program advisor. Students pursuing Senior Departmental Honors should also meet with the Computer Science Honors Coordinator. Application to this program should be made by the end of the junior year but may be made at any time from the junior year until one semester prior to the expected BS graduation. Application details are available in the Undergraduate Announcements.

The Computer Science faculty envision students enrolled in this combined degree program will typically complete nine hours of graduate credit while completing their BS degree requirements and complete the remaining requirements for the MS degree in one calendar year or less of graduate study.

**DIGITAL PRODUCTION ARTS**

**Master of Fine Arts**

The Digital Production Arts program at Clemson University is a professional degree program aimed at producing graduates who will be sought by the growing electronic arts industry, particularly by those companies engaged in special effects production within the entertainment, film and gaming industries. Because the MFA is a terminal degree in fine arts, students will also be prepared to accept university faculty positions. The program is offered within the Division of Visual Computing in the School of Computing, with significant collaboration with the departments of Art and Performing Arts. It offers a unique blend of instruction, with coursework ranging from the artistic to the technical, all with a strong emphasis on advanced studio methods for visual problem solving.

The Master of Fine Arts in Digital Production Arts is administered by a supervisory board, chaired by the program director, and consisting of five additional faculty members—two from the Division of Visual Computing, two from the Department of Art, and one from the Department of Performing Arts.

**Admission and Financial Aid**

Applicants are required to submit GRE general test results, a portfolio of artistic work that may include slides or electronic media, and evidence of technical preparation that may include software code samples or appropriate coursework. Some assistantships may be available to especially well qualified applicants. For full consideration for admission and financial aid, applications should be received by January 10.
Requirements for Awarding of a Degree

The degree requires 60 hours, 12 of which are devoted to team-based studio work, six to individual studio work, and six to thesis preparation. This assures that students have participated in the development of several complete digital production projects, providing material for a professional quality demonstration "real." Of the remaining 36 credit hours, 0-6 will come from foundation courses, 15 from core courses, three from aesthetic electives, and 12-18 from general electives, aesthetic electives, or core courses. Any required foundation courses are determined at the time of admission. These courses provide students with post baccalaureate work in the fundamentals of computing or the visual arts. A maximum of six hours of foundation courses may be counted towards the degree. For students with strong preparation, the course of study requires two calendar years.

Foundation Courses—Selected from D P A 600, 601 (technical), 602, 603 (artistic)

Core courses—Selected from ART 821, CP SC 604, 807, 809, 815, THEA 687


Studies—D P A 860, 880, 891

ELECTRICAL ENGINEERING

Master of Engineering

Master of Science

Doctor of Philosophy

Students in Electrical Engineering may direct their programs toward the fields of communication systems and networks, digital signal processing, intelligent systems, applied electromagnetics, electronics, or power systems.

For the MS program, students may write a thesis or follow a nonthesis option. The thesis option requires a total of 30 credit hours, including six hours of thesis research. For the nonthesis option, 33 credit hours of coursework must be completed.

The Master of Engineering is a special degree offered for off-campus students through the University telecampus program. Degree requirements include 24 credit hours of coursework and six hours of credit for an engineering report. Additional information is available from the Office of Off-Campus, Distance and Continuing Education.

The PhD program requires at least 24 credit hours of graduate coursework beyond the master’s degree and 18 research credit hours. Specially qualified candidates with a BS degree may apply for direct entry to the PhD program in any of the above areas. The program of study and hours required beyond the baccalaureate degree are specified by the focus area, but must be at least 60, including coursework and research credit.

Detailed information on program requirements and application procedures is available at www.clemson.edu/courses/department/ee.

ENGINEERING AND SCIENCE EDUCATION

Certificate

The Certificate in Engineering and Science Education is designed for graduate students who want to prepare for an academic career, who wish to further their understanding of the education process in engineering and science, or who are interested in engineering and science education research. The program includes a range of courses in three main areas: Pedagogy, Professional Preparation, and Research Methods, as well as a practicum and attendance at a seminar series, for a total of 11 credits as outlined below. Additional information is available at www.clemson.edu/ece/.

Pedagogy—Three credits: CES 820 or 821 or ED 955

Professional Preparation—Three credits: CES 825, 875, or 888

Elective—Three credits: CES 871, ED F 808 or 878, EX ST 802, PSYCH 811 or 833

Practicum—One credit: CES 861

Seminar—One credit: CES 800

ENVIRONMENTAL ENGINEERING AND SCIENCE

Master of Engineering

Master of Science

Doctor of Philosophy

Environmental engineering and science is concerned with the characterization and control of environmental pollution. Emphasis is placed on applying the fundamental principles of the basic and engineering sciences through research and design to the solution of environmental problems in natural and engineered systems.

The MEng program builds on an ABET-accredited engineering baccalaureate background, while the MS program builds on a student’s previous engineering or science background. Students with a baccalaureate degree in any branch of engineering, as well as chemistry, physics, geology, biology, or related majors with a strong mathematical background may be admitted to the program.

Students may specialize in one of six areas: environmental health physics; environmental process engineering; nuclear environmental engineering and science; sustainable systems and environmental assessment; subsurface and surface processes; or environmental chemistry. Research master’s degree candidates must complete 24 hours of coursework and six hours of research culminating in the presentation of a satisfactory thesis for MS candidates or a special problem report for MEng candidates. The MS nonthesis option, which requires 30 hours of coursework and three hours of independent study, is available. The coursework for all master’s students must include EES’s 802, 843, and 851. A final examination is required of all master’s candidates.

The PhD program provides the student with a comprehensive background in the fundamental aspects of environmental engineering and science. The major field of study is generally interdisciplinary in nature, consisting of at least 30 hours of coursework beyond the MS degree in several areas of engineering and the basic sciences. Each student’s curriculum and research program is tailored to suit his/her personal and professional goals. Qualifying, comprehensive and final examinations are required. No foreign language is required.

Combined BS in Biosystems Engineering/MS, MEng in Environmental Engineering and Science

Under this plan, students may reduce the time necessary to earn both degrees by applying graduate credits to both undergraduate and graduate program requirements. Students are encouraged to obtain the specific requirements for the dual degree from the Department of Environmental Engineering and Earth Sciences as early as possible in their undergraduate programs. Enrollment guidelines and procedures can be found in the Undergraduate Announcements.

Combined BS in Chemical Engineering/MS, MEng in Environmental Engineering and Science

Undergraduate Chemical Engineering majors who have earned a grade-point ratio of 3.4 or above and completed 90 credit hours can begin work toward a Master of Science or Master of Engineering in Environmental Engineering and Science while completing a Bachelor of Science degree. The undergraduate curriculum allows up to nine credits of mutually acceptable graduate course credits to satisfy requirements of both degrees. Details are available in the ChBE Undergraduate Handbook, which can be found at www.clemson.edu/ces/chbe.

HYDROGEOLOGY

Master of Science

The Master of Science in Hydrogeology is an interdisciplinary program that focuses on groundwater geology and subsurface remediation and draws on the expertise of faculty in the Department of Environmental Engineering and Earth Sciences. The curriculum is structured to impart a strong background in field experimentation complemented by laboratory studies and computer modeling.

Candidates for the Master of Science degree in Hydrogeology should have a baccalaureate degree in the geosciences; however, students having strong undergraduate backgrounds in other fields of science or related engineering disciplines may be admitted but will be required to correct deficiencies in their geological education during the first year. Specifically, GEOL 101/103, 205, 302, 313, and 316 (or an equivalent) are required. Students entering this program should also have a strong mathematics background; normally, two semesters of calculus are required and a third semester is recommended.
The Materials Science and Engineering program offers options for a Master of Science and a Doctor of Philosophy degree. The Master of Science program requires a total of 48 hours of graduate coursework and the Doctor of Philosophy degree requires a total of 90 hours of graduate coursework. All candidates must complete a thesis or coursework, including six credits of thesis research. Students in the nonthesis option must complete a minimum of 33 hours of graduate coursework.

Students with baccalaureate degrees in engineering and a mastery of the methods of research. All candidates must take at least six core courses. A minimum of 90 hours of graduate coursework beyond a baccalaureate degree is required. Since a minimum of 48 hours of graduate coursework is required by the Graduate School. Additional information can be found in the Program Announcements.

The Master of Science degree represents specialization coupled with a broad foundation in all materials. The curriculum provides for specialization in metalurgy, glasses and ceramics, and polymeric materials, including electronic materials, biomaterials, polymer and textile science, fiber and composite materials, and physical properties.

The Materials Science and Engineering program is interdisciplinary in nature, consisting of coursework and independent systems that include people, materials, information, equipment, and energy. In addition to addressing engineering challenges, graduates learn to address communications issues, and to integrate systems that include people, materials, information, equipment, and energy. Work in the Materials Science and Engineering program provides students with access to cutting-edge research and development opportunities.

The Materials Science and Engineering program is an interdisciplinary program that focuses on educational coursework and laboratory work. Involvement in laboratories and field work is critical to the program’s success. Students will be expected to complete a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination. Students must pass a comprehensive examination.
MASTER OF SCIENCE
Doctor of Philosophy

Enrollment in the MS and PhD programs is open to students with degrees in physics, applied mathematics, or any branch of engineering. Students in the MS degree program may choose the thesis or nonthesis option. Students in the thesis program must complete 30 credit hours of coursework, including six hours of thesis research and write a thesis. Students in the nonthesis program must complete 33 credit hours of coursework and pass an exit examination. Students in the PhD program must pass a qualifying exam, complete 18 hours of dissertation research and defend a dissertation. Programs may be selected with concentrations in mechanical and manufacturing systems design (design, dynamics, vibrations, and control, materials and manufacturing), thermal/fluid sciences (computational fluid dynamics, fluid mechanics, heat transfer, thermodynamics and energy systems) or engineering mechanics (solid mechanics, composite materials, numerical computation methods and experimental methods).

PHOTONIC SCIENCE AND TECHNOLOGY
Master of Science
Doctor of Philosophy

The Photonic Science and Technology program, jointly administered by the Center of Optical Materials Science and Engineering Technologies (COMSET), the College of Engineering and Science, and the Graduate School, offers interdisciplinary graduate degrees in science, engineering, communications, entrepreneurship, business, and leadership. The program prepares individuals with the fundamentals of the science and engineering of light and specific interactions targeted for relevance to the research areas of their home academic department(s) and collaboratively co-advised graduate committees. Students with backgrounds in any relevant science or engineering discipline who have earned an undergraduate degree from an accredited college or university may be accepted. Undergraduate prerequisite or corequisite courses may be required for applicants with undergraduate degrees in nonengineering or nonscientific disciplines.

Acceptance is determined by COMSET faculty review based on records of academic achievements, including grades from previous programs and GRE scores, and other appropriate professional accomplishments. Each degree program is planned individually to augment the student's previous engineering and science background with adequate breadth in science or engineering and specialization in an area of photonic science or engineering. Coursework includes photonic science and technology and related engineering and sciences currently offered in the member departments and schools of COMSET. Candidates for the MS degree are required to complete a minimum of 30 credit hours, including 12 credit hours of core courses, three credit hours of PST seminar, nine credit hours of elective courses, and an additional six credit hours of thesis research, and complete an acceptable thesis. Candidates for the PhD degree are required to complete a minimum of 30 credit hours, including nine credit hours of core courses, three credit hours of PST seminar, nine credit hours of elective courses, and an additional 15 credit hours of dissertation research, and complete an acceptable dissertation.

PHYSICS
Master of Science
Doctor of Philosophy

Graduate studies in physics and astronomy may be pursued by well-prepared students in the physical and mathematical sciences or engineering. As the basic physical science, physics offers unique intellectual opportunities. Theoretical, experimental, or computer-simulated studies of the physical universe, ranging from cosmology to quantum physics, from astrophysical phenomena to biomolecular events, are available. Normally, students are directly accepted into the PhD program. The ultimate goal is to carry out and publish independent scientific work in a chosen research field. Coursework required for the PhD includes 18 credit hours of the core curriculum consisting of PHYS (M E) 815, 821, 841, 842, 951, 952 (or their equivalents), and 12 credit hours of elective 800–900-level physics, astronomy or other graduate level courses (excluding PHYS 891/991), which must be approved by the student’s advisory committee. PHYS/ASTR 875 courses may be used to satisfy this requirement with approval by the faculty. The purpose of these electives is to provide a well-rounded physics education and additional coursework necessary for the student’s research area.

Unless they receive a deferral from the Department faculty, students must take the written PhD qualifying examination on topics from the core curriculum no later than their third semester. Students are offered two opportunities to pass the exam, which is typically offered twice annually. After passing the written PhD qualifying examination, students shall have selected a research area and faculty advisor and prepare for the oral PhD qualifying examination in which they present and defend their planned dissertation topic and research program. This oral examination must be completed within 12 months after passing the written examination. At least three weeks prior to the graduation at which the candidate expects to receive the PhD degree, a final oral examination on the dissertation must be successfully completed.

Students not passing the written PhD qualifying examination after two attempts may, with the approval of the Department faculty, complete an MS degree. Such students, and those accepted directly into the MS program, usually choose to prepare a research thesis, although a nonthesis option is available. For the thesis option, 30 credit hours and a final oral examination on the general area of study and thesis defense are required. In the nonthesis option, 36 credit hours are required, including six credit hours of PHYS 890. A written report must be submitted on the directed studies. A final oral examination on the general area and directed activities completes the requirements for the nonthesis option.