COLLEGE OF ENGINEERING AND SCIENCE

The College of Engineering and Science offers a broad range of rigorous and stimulating baccalaureate programs that provide unexcelled educational opportunities. The innovative combination of engineering and science disciplines that comprises the College, facilitates study and research in fields transcending the traditional disciplines. Students enjoy close interaction with a distinguished faculty committed to excellence in undergraduate education, as well as in research. Additional information on the College and its programs is available at www.clemson.edu/ces.

Minors

Engineering and science students can complement their majors by selecting minor concentrations of study. Available minors include Environmental Engineering, International Engineering and Science, and one in each of the science majors (see page 106).

International Programs

The world economy has become very tightly integrated, making it highly important that engineering and science students prepare themselves for this global environment. The College offers a minor in International Engineering and Science coupled with several programs that provide opportunities for students to gain international experience. These include study abroad at many locations around the world and EPIC (an international co-op program). In addition, engineering and science students are encouraged to pursue study of a foreign language. Information is available in the Undergraduate Studies Office (107 Riggs Hall) and at www.clemson.edu/ces/students/global.

ENGINEERING PROGRAMS

The Bachelor of Science engineering degree programs in Biomedical Engineering, Ceramic and Materials Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, and Mechanical Engineering are each accredited by the Engineering Accreditation Commission (EAC) of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700. The Biomedical Engineering program is administered jointly with the College of Agriculture, Forestry and Life Sciences. The new BS degree Programs in Bioengineering and Environmental Engineering are designed to meet ABET requirements and will be submitted to ABET for accreditation review when eligible.

All engineering programs have the common goal of producing engineering graduates who are able to

- design systems or components to meet needs within realistic constraints
- function on multidisciplinary teams
- communicate effectively
- conduct themselves professionally and ethically
- understand engineering's global, economic, environmental, and societal context
- understand contemporary engineering issues
- apply modern engineering methods and tools
- appreciate the need for lifelong learning

Each engineering program has objectives specific to the discipline. All prepare students for a wide range of career opportunities and provide sound preparation for graduate study. Each curriculum provides opportunities for students to pursue individual areas of interest.

Admission Requirements

The University admission requirements are given under the section entitled Admission. Engineering applicants are strongly advised to include the following in their high school programs:

Mathematics—Four units, including geometry, trigonometry, and introductory calculus

Laboratory Science—At least three units, including both chemistry and physics

Computing—At least one unit, including introduction to a programming language. Applicants should have good keyboarding skills.

General Engineering Program

All new engineering students (including transfer students who have not completed all courses in the freshman engineering curriculum) are admitted into General Engineering. The General Engineering Program provides students an opportunity to explore various engineering fields while getting a sound academic preparation for engineering study.

Freshman Curriculum

First Semester

1 - CMPGE 105 Introduction to Engineering
2 - CES 102 Engineering Disciplines and Skills
3 - ENGL 101 General Composition
4 - MTHSC 106 Calculus of One Variable I

Second Semester

1 - CES 102 Engineering Disciplines and Skills
2 - CHE 101 General Chemistry
3 - ENGL 103 General Composition
4 - MTHSC 108 Calculus of One Variable II

General Education Requirements for Engineering Curricula

Engineers have an obligation to practice their profession in a socially responsible manner. The education of engineers must prepare them for this responsibility and make them aware of the constraints imposed by societal and cultural factors. Thus, the humanities and social sciences are an important component of the engineering curriculum. Further, the program of study must include educational experiences addressing the intersection of science and technology with society and cross-cultural awareness.

In addition to the University General Education Requirements, some engineering majors are required to complete additional credit hours from a college approved list. Individual engineering curricula may have more specific requirements. For a complete list of acceptable courses, please speak with an advisor.

Admission into Engineering Degree Programs

To transfer into an engineering degree program, a student must have completed the following courses in the freshman engineering curriculum with a grade of C or better:

1 - CHE 101 General Chemistry
2 - CES 102 Engineering Disciplines and Skills
3 - ENGL 103 General Composition
4 - MTHSC 106 Calculus of One Variable I
5 - MTHSC 108 Calculus of One Variable II
6 - PHYS 122 Physics with Calculus I
7 - PHYS 122 Physics with Calculus II
8 - CE 101 Introduction to Engineering

Admission to an engineering degree program requires a cumulative grade point average of 2.0 or better.

Registration Requirements

A cumulative grade point average of 2.0 or higher is required for registration in engineering courses numbered 300 or higher. Priority for registration in engineering courses is given to those majors for whom the course is a degree requirement. Exceptions to this requirement may be granted by the department offering the course.

87
Graduation Requirements
In addition to other institutional requirements, candidates for a baccalaureate degree in Engineering are required to have a 2.0 or higher cumulative grade-point ratio in all engineering courses taken at Clemson. All courses with “Engineering” in the course designator (e.g., E NGR 130, M E 453, etc.) are used in this calculation.

The baccalaureate programs in Engineering are designed to be completed in four years (eight regular semesters). Taking a reduced load or participating in cooperative education will extend this time. On average, Clemson engineering students take about four and one-half years to complete the requirements for graduation.

BIOENGINEERING
Bachelor of Science
The undergraduate program in Bioengineering is built upon a rigorous engineering science foundation that is, in turn, based upon a broad curriculum of applied and life sciences, mathematics, electives in humanities, social science, and design. Students select a formal focus that concentrates in a subfield of interest in bioengineering: Biomaterials Concentration or Bioelectrical Concentration.

The curriculum provides undergraduates with a solid background in engineering and life sciences in preparation for advanced studies. Through the Bioengineering program, graduates acquire an understanding of biology, biochemistry, and physiology and the capability to apply advanced mathematics, including differential equations and statistics, science, and engineering, to solve the problems at the interface of engineering and biology. Graduates also have an ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and nonliving materials and systems.

Combined Bachelor’s/Master’s Plan
Bioengineering 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 the undergraduate and graduate degrees. Details are available from the Department of Bioengineering.

BIOELECTRICAL CONCENTRATION
Freshman Year
First Semester
1. E C E 307 Basic Electrical Engineering
2. E C E 309 Electrical Engineering Lab. I
3. E C E 311 Electrical Engineering Lab. III
4. MTHSC 207 Calculus of Several Variables
5. CH 101 General Chemistry
6. CH 102 General Chemistry
16

Second Semester
1. E C E 400 Senior Seminar
2. E C E 403 Applied Biomedical Design
3. E C E 448 Tissue Engineering
4. MTHSC 208 Intro. to Ordinary Diff. Equations
5. BIOE 401 Bioengineering Design Theory
6. Bioengineering or E C E Technical Requirement
16

128 Total Semester Hours

Notes:
1. To transfer from General Engineering into the Bioengineering degree program, students must have a minimum cumulative grade-point ratio of 3.0 in courses taken at Clemson and must have earned a C or better in each course in the General Engineering freshman curriculum, including the Arts and Humanities/Social Science Requirements.
2. A student is allowed to enroll in E C E courses (excluding E C E 307, 308, 309) only when all prerequisites have been passed with a grade of C or better.
3. All Bioelectrical Concentration students must have a cumulative engineering grade-point ratio of 2.0 to enroll in any 300- or 400-level E C E courses.
4. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any E C E course.

BIOMATERIALS CONCENTRATION
Freshman Year
First Semester
1. E C E 309 Electrical Engineering Lab. I
2. E C E 311 Electrical Engineering Lab. III
3. E C E 320 Electronics I
4. MTHSC 208 Intro. to Ordinary Diff. Equations
5. CH 101 General Chemistry
6. CH 102 General Chemistry
16

Second Semester
1. E C E 307 Basic Electrical Engineering
2. E C E 308 Electrical Engineering Lab. II
3. E C E 330 Signals, Systems, and Transforms
4. MTHSC 206 Calculus of Several Variables
5. CH 201 Survey of Organic Chemistry
6. BIO 401 Bioengineering Design Theory
16

Junior Year
First Semester
1. E C E 309 Electrical Engineering Lab. I
2. E C E 311 Electrical Engineering Lab. III
3. E C E 320 Electronics I
4. MTHSC 208 Intro. to Ordinary Diff. Equations
5. CH 101 General Chemistry
6. CH 102 General Chemistry
16

Second Semester
1. E C E 309 Electrical Engineering Lab. I
2. E C E 311 Electrical Engineering Lab. III
3. E C E 320 Electronics I
4. MTHSC 208 Intro. to Ordinary Diff. Equations
5. CH 101 General Chemistry
6. CH 102 General Chemistry
16

Senior Year
First Semester
1. E C E 309 Electrical Engineering Lab. I
2. E C E 311 Electrical Engineering Lab. III
3. E C E 320 Electronics I
4. MTHSC 208 Intro. to Ordinary Diff. Equations
5. CH 101 General Chemistry
6. CH 102 General Chemistry
16

Second Semester
1. E C E 309 Electrical Engineering Lab. I
2. E C E 311 Electrical Engineering Lab. III
3. E C E 320 Electronics I
4. MTHSC 208 Intro. to Ordinary Diff. Equations
5. CH 101 General Chemistry
6. CH 102 General Chemistry
16

1See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.
2Students planning to enter medical school should take CH 223/227 instead of CH 201 and take CH 224/228 as an additional course sequence. Students planning to enter medical school should also take physics laboratories as additional courses (PHYS 124 and PHYS 223).
3Select from department-approved list.

Notes:
1. To transfer from General Engineering into the Bioengineering degree program, students must have a minimum cumulative grade-point ratio of 3.0 in courses taken at Clemson and must have earned a C or better in each course in the General Engineering freshman curriculum, including the Arts and Humanities/Social Science Requirements.
2. A student is allowed to enroll in E C E courses (excluding E C E 307, 308, 309) only when all prerequisites have been passed with a grade of C or better.
3. All Bioelectrical Concentration students must have a cumulative engineering grade-point ratio of 2.0 to enroll in any 300- or 400-level E C E courses.
4. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any E C E course.

College of Engineering and Science
BIOSYSTEMS ENGINEERING

Bachelor of Science

Biosystems engineering is a science-based engineering discipline that integrates engineering science and design with applied biological, biochemical and environmental sciences. Biosystems engineers use engineering analysis and design to solve problems involving microorganisms, animals, humans and ecosystems. The biosystems engineering degree program is unique among engineering disciplines because it incorporates bioprocess, structural and mechanical design.

The B.S. in Biosystems Engineering is nationally accredited by ABET, the Accreditation Board for Engineering and Technology. Students who receive the Bachelor of Science degree are eligible for licensing as professional engineers after gaining acceptable experience and passing the Fundamentals of Engineering and the Principles and Practice of Engineering examinations.

Undergraduate students in Biosystems Engineering may participate in exciting research opportunities in the areas of water quality, bioprocessing, non-point source pollution, instrumentation and control, and biofuels production.

Graduates in biosystems engineering are well equipped to use their expertise in engineering in many areas that affect our quality of life and environment. They have broad training in mathematics, physics, chemistry and biological sciences, as well as a sound background in the engineering sciences. Biosystems engineers are sought by industry and public service organizations primarily for their ability to apply engineering expertise to living systems and to the management of land and water resources.

For further information, visit http://www.clemson.edu/cafls/departments/biosystemseng/beng/

Combined Bachelor's/Master's Program

Under this plan, students may reduce the time necessary to earn both degrees by applying graduate credits to both undergraduate and graduate program requirements.

Undergraduate students in Biosystems Engineering may begin a Master of Science or a Master of Engineering Degree in Environmental Engineering and Science while completing the BS degree. Students in the Applied Biotechnology Concentration may apply graduate credits toward a Master of Science Degree in Bioengineering.

Students are encouraged to obtain the specific requirements for the dual degree from the academic departments involved as early as possible in their undergraduate program. See Academic Regulations in this catalog for enrollment guidelines and procedures.
Second Semester
3 - B E 435 Appl. in Biotechnology Engineering
2 - B E 475 Biosystems Engr. Capstone Design
3 - Arts and Humanities Requirement 1  or
3 - Social Science Requirement 1
3 - Engineering Requirement 1
2 - Elective
13

128 Total Semester Hours

1See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.
2See advisor. Select from department-approved list.
3CH 223 and 227 (preferred) or CH 201
4BIOCH 101/302 or 305/306
5MICRO 413 or any approved 300–400-level course in BIOCH, BIO/SC, GEN, or MICRO

Notes:
1. Biosystems Engineering students are allowed to enroll in upper-level B E courses only when the following prerequisites have been completed with C or better: C E 206, 208, 341, CH E 220, 230, E M 201, 302, M E 201, 302, 310, MTHSC 206, 208, PHYS 221.
2. Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Life Science and Engineering Requirements.
3. To complete premedicine requirements, students must take BIOL 104/106 or 111, CH 224, 228, and PHYS 124, 125 as additional courses.

NATURAL RESOURCES AND ENVIRONMENT CONCENTRATION

Freshman Year
First Semester
2 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement 1  or
3 - Social Science Requirement 1
16

Second Semester
4 - CH 102 General Chemistry
2 - ENGR 130 Engineering Fundamentals
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement 1  or
3 - Social Science Requirement 1
16

Sophomore Year
First Semester
2 - B E 210 Intro. to Biosystems Engineering
2 - B E 222 Geomeasurements
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
4 - Biology Requirement 1
3 - Statics Requirement 1
18

Second Semester
2 - B E 212 Fundamentals of Biosystems Engr.
2 - E G 209 Intro. to Engr./Comp. Graphics
3 - M E 310 Thermodynamics and Heat Transfer
4 - MICRO 305 General Microbiology
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
2 - Dynamics Requirement 1
17

Junior Year
First Semester
3 - B E 312 Biol. Kinetics and Reactor Modeling
4 - C E 321 Geotechnical Engineering  or
4 - CSENV 202 Soils
4 - C E 341 Introduction to Fluid Mechanics
2 - E C E 307 Basic Electrical Engineering
3 - Mechanics of Materials Requirement 2
16

Second Semester
3 - B E 314 Biosystems Engr. Mechanical Design  or
3 - M E 306 Fundamentals of Machine Design
3 - B E 322 Small Watershed Hydrology and Sedimentology
3 - B E 412 Heat and Mass Transport in B E
4 - B E 415 Instrumentation and Control for B E
3 - Structural Design Requirement 1
16

Senior Year
First Semester
3 - B E 414 Biosystems Engr. Unit Operations
3 - B E 464 Non-Point Source Management in Engineered Ecosystems
3 - Arts and Humanities Requirement 1  or
6 - Social Science Requirement 1
3 - Engineering Requirement 2
17

Second Semester
2 - B E 421 Engineering Syst. for Soil Water Mgt.
2 - B E 475 Biosystems Engr. Capstone Design
3 - Arts and Humanities Requirement 1  or
3 - Social Science Requirement 1
3 - Engineering Requirement 1
2 - Elective
12

128 Total Semester Hours

CERAMIC AND MATERIALS ENGINEERING

Bachelor of Science

The School of Materials Science and Engineering offers undergraduate degrees in Ceramic and Materials Engineering, and Polymer and Fiber Chemistry.

Ceramic and materials engineers design, develop, and participate in the manufacture of both standard and new materials intended for use in a wide variety of industries with diverse applications. These range from the traditional materials industries, such as structural clay, foundry, or whiteware industries to the newer industries, such as the semiconductor or aerospace industries. The broad career responsibilities of this discipline require competence in science, engineering, mathematics, and the social sciences.

The curriculum develops skills in problem solving, engineering analysis, and design as well as oral and written communication.

The baccalaureate program integrates laboratory with classroom experiences to prepare students for life-long learning. Courses covering thermodynamics, kinetics, mechanical behavior, processing, and characterization of materials prepare students for careers in industry and/or for graduate school.

In addition to the common educational objectives of all engineering programs, baccalaureate degree graduates in Ceramic and Materials Engineering will be able to:

- demonstrate learning consistent with Accreditation Board for Engineering and Technology Engineering Criteria 2000 for ceramic and materials engineering programs
- function easily and well in the laboratory and plant environments and
- serve the local, national, and international ceramic and materials communities

Specifically, the Accreditation Board for Engineering and Technology Engineering Criteria 2000 requires that baccalaureate degree graduates in Ceramic and Materials Engineering be able to:

- apply advanced scientific and engineering principles to materials systems
- demonstrate an integrated understanding of the scientific and engineering principles underlying structure, properties, processing, and performance relationships
- apply this understanding to the solution of ceramic and materials engineering selection and design problems and
- apply appropriate experimental, statistical, and computational methods to advantage in the solution of ceramic and materials problems

Freshman Year
First Semester
2 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement 1  or
3 - Social Science Requirement 1
16
Second Semester
1 - CH 102 General Chemistry
2 - EGR 130 Engineering Fundamentals
3 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
   16

Sophomore Year
First Semester
3 - C M E 210 Introduction to Materials Science
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
6 - Arts and Humanities Requirement1 or
   6 - Social Science Requirement1
   16

Second Semester
1 - C M E 241 Metrics Lab.
3 - C E 201 Statics
2 - E G 209 Intro. to Engr./Computer Graphics
3 - MSE 324 Statistics for Materials Science and Engineering
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
   16

Junior Year
First Semester
3 - C M E 319 Materials Processing I
3 - C M E 326 Thermodynamics of Materials
3 - C M E 327 Transport Phenomena
3 - COMM 250 Public Speaking
3 - Technical Writing Requirement2
   15

Second Semester
3 - C M E 328 Phase Diagrams for Materials Processing and Applications
2 - C M E 342 Structure/Property Lab.
3 - C M E 361 Process of Metals and Composites
3 - C M E 422 Mechanical Behavior of Materials
3 - I E 384 Engineering Economic Analysis
3 - PFC 303 Textile Chemistry
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
   17

Senior Year
First Semester
3 - C M E 402 Solid State Materials
3 - C M E 413 Noncrystalline Materials
3 - C M E 432 Manufacturing Processes and Sys.  
1 - C M E 441 Manufacturing Lab.
3 - PFC 415 Intro. to Polymer Science and Engr.
3 - Research Requirement2
   16

Second Semester
3 - C M E 407 Senior Capstone Design
3 - C M E 416 Electronic Properties of Materials
3 - C M E 424 Optical Materials and Applications
3 - C M E 433 Combustion Systems and Environmental Emissions
1 - C M E 445 Practice of Materials Engineering
125 Total Semester Hours

See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

CHEMICAL ENGINEERING

Bachelor of Science

The Department of Chemical and Biomolecular Engineering offers the Bachelor of Science degree in Chemical Engineering. Chemical Engineering students select one of several emphasis areas (such as energy studies or environmental engineering), a concentration in Biomolecular Engineering (to prepare them for medical school or a career in biotechnology), or any approved minor.

Chemical engineering is based on chemistry, biology, physics, and mathematics. The curriculum at Clemson includes classroom and laboratory instruction and emphasizes broadly applicable fundamental principles and current technology to prepare graduates for professional practice and professional growth. Graduates will have careers characterized by success in chemical engineering practice, post-graduate education, or other areas such as medicine and law that make use of engineering skills; demonstrated success in the design of chemical processes and/or identification, formulation, and solution of chemical engineering problems; ethical behavior in all endeavors; demonstrated effectiveness in teamwork, communication, and service to society through their professional contributions; demonstrated technical and/or managerial leadership; and demonstrated commitment to lifelong learning.

Chemical engineers are involved in the research, manufacture, sale, and use of commodity and specialty chemicals, fuels, pharmaceuticals, electronic components, synthetic fibers and textiles, food and consumer goods, and many other products. They work on environmental pollution prevention and remediation and apply engineering science to solve medical and health-related problems.

The Department of Chemical and Biomolecular Engineering also offers advanced study leading to the Master of Science and Doctor of Philosophy degrees. Additional information is available at www. ces.clemson.edu/chemeng.

Freshman Year

First Semester
2 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
   16

Second Semester
4 - CH 102 General Chemistry
4 - CH E 130 Chemical Engineering Tools
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
   17

Sophomore Year

First Semester
3 - CH 223 Organic Chemistry
4 - CH E 211 Intro. to Chemical Engineering
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
   17

Second Semester
3 - CH 224 Organic Chemistry
1 - CH 229 Organic Chemistry Lab.
3 - CH E 220 Chemical Eng. Thermodynamics I
4 - CH E 230 Fluids/Heat Transfer
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
15

Junior Year

First Semester
1 - CH 339 Physical Chemistry Lab.
3 - CH E 307 Unit Operations Lab. I
3 - CH E 319 Engineering Materials
2 - E C E 307 Basic Electrical Engineering
1 - E C E 309 Electrical Engineering Lab. I
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
   17

Second Semester
3 - CH 332 Physical Chemistry
1 - CH 340 Physical Chemistry Lab.
3 - CH E 321 Chemical Engr. Thermodynamics II
4 - CH E 330 Mass Transfer and Separation Proc.
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
   3 - Emphasis Area Requirement1
   17

Senior Year

First Semester
3 - CH E 407 Unit Operations Lab. II
3 - CH E 431 Chemical Process Design I
1 - CH E 443 Chemical Engr. Senior Seminar I
3 - CH E 450 Chemical Reaction Engineering
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
   3 - Emphasis Area Requirement1
   17

Second Semester
3 - CH E 335 Process Dynamics and Control
3 - CH E 433 Process Design II
1 - CH E 444 Chemical Engr. Senior Seminar II
3 - MICRO 413 Industrial Microbiology
3 - Emphasis Area Requirement1
   13

127 Total Semester Hours

See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.

2BIOCH 301, 305, or 423

See advisor for details. Nine credit hours devoted to completion of an emphasis area or approved minor are required. Emphasis areas are Applied Engineering, Mathematics, and Science; Biomolecular Science and Engineering; Business Management; Environmental Engineering; Polymeric Materials; Energy Studies.

Note: No student may exceed a maximum of two attempts, including a W, to complete successfully any CH E course.
BIOMOLECULAR ENGINEERING

Freshman Year
First Semester
2 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Second Semester
1 - BIOL 105 General Biology Lab. I
3 - BIOL 103 General Biology I
16

Second Year
First Semester
4 - CH 102 General Chemistry
3 - CH E 130 Chemical Engineering Tools
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Sophomore Year
First Semester
3 - CH 223 Organic Chemistry
4 - CH E 211 Intro. to Chemical Engineering
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Second Semester
3 - BIOCH 301 Molecular Biochemistry
2 - BIOCH 302 Molecular Biochemistry Lab.
3 - CH 224 Organic Chemistry
1 - CH 229 Organic Chemistry Lab.
3 - CH E 220 Chemical Engr. Thermodynamics I
4 - CH E 230 Fluids/Heat Transfer
17

Junior Year
First Semester
3 - BIOL 103 General Biology I
1 - BIOL 105 General Biology Lab. I
3 - CH E 307 Unit Operations Lab. I
3 - CH E 319 Engineering Materials
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Second Semester
3 - BIO E 302 Biomaterials
3 - BMOLE 425 Biomolecular Engineering
3 - CH E 321 Chemical Engr. Thermodynamics II
4 - CH E 330 Mass Transfer and Separation Proc.
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Senior Year
First Semester
3 - BIOCH 431 Physical Approach to Biochemistry
3 - BMOLE 403 Biotransport Phenomena
3 - CH E 407 Unit Operations Lab. II
3 - CH E 431 Chemical Process Design I
1 - CH E 443 Chemical Engr. Senior Seminar I
3 - CH E 450 Chemical Reaction Engineering
16

CIVIL ENGINEERING

Bachelor of Science
Civil Engineering involves the planning, design, construction management, operation, and maintenance of facilities and systems in the built environment, including bridges, buildings, airports, water supply systems, ports, dams, and highways.

The Bachelor of Science degree program in Civil Engineering includes the common educational goals listed on page 87 for the College of Engineering and Science. The complete objectives of the program can be found at www.ce.clemson.edu.

The first two years provide students with building blocks necessary to be successful civil engineers, including proficiency in calculus, engineering mechanics, physics, and chemistry. During the junior year, students receive a broad introduction to the fundamental areas of civil engineering (structures, hydraulics, geotechnical, transportation, environmental, construction materials, and construction engineering and management). Design experiences are integrated throughout the curriculum, culminating in the senior year with a major capstone design project. In addition, during the senior year, students can select from available emphasis areas that serve to strengthen their undergraduate background.

The Civil Engineering program prepares students to work immediately upon graduation in most areas of civil engineering or to pursue graduate degrees. Students are also exposed to issues related to professional practice, including professional registration, lifelong learning, and communication and team skills. Because a concerned society demands a realistic consideration of the impacts of engineering projects, civil engineering students are also educated in the broad areas of the humanities and social sciences.

The Department of Civil Engineering allows eligible students to count up to six hours of graduate credit (600- and 800-level courses) toward both the bachelor’s and master’s degrees. Students participating in this program must have completed the junior year, must have earned a minimum 3.4 grade-point ratio, and must be approved by the department. Details of the suggested curriculum and program information are available from the department.

Freshman Year
First Semester
1 - ENGR 130 Engineering Fundamentals
2 - GEOL 103 Physical Geology
1 - GEOL 103 Physical Geology Lab.
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Second Semester
2 - ENGR 130 Engineering Fundamentals
3 - GEOL 101 Physical Geology
1 - GEOL 103 Physical Geology Lab.
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Sophomore Year
First Semester
3 - C E 201 Statics
2 - E G 210 Intro. to Engr./Computer Graphics
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Second Semester
4 - C E 206 Structural Mechanics
2 - C E 208 Dynamics
3 - C E 255 Geomatics
2 - C E 352 Economic Evaluation of Projects
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
15

Junior Year
First Semester
3 - C E 301 Structural Analysis
3 - C E 331 Construction Engineering and Mgr.
4 - C E 341 Introduction to Fluid Mechanics
4 - C E 351 Civil Engineering Materials
3 - EX ST 301 Introductory Statistics
17

Second Semester
3 - C E 311 Transportation Engineering Planning and Design
4 - C E 321 Geotechnical Engineering
3 - C E 342 Applied Hydraulics and Hydrology
1 - C E 353 Professional Seminar
3 - EE&S 401 Environmental Engineering
3 - Design Technical Requirement2
17

Senior Year
First Semester
3 - ENGL 314 Technical Writing
3 - Design Technical Requirement2
6 - Technical Requirement3
3 - Technical Requirement Restricted1
15
Second Semester
- C E 459 Capstone Design Project
- Arts and Humanities Requirement\(^ \ast \) or
  - Social Science Requirement\(^ \ast \)
- Arts and Humanities (Literature) Requirement\(^ \ast \)
- Technical Requirement\(^ \ast \)
- Elective
15

128 Total Semester Hours

See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

See advisor for approved list.

See advisor for approved list. Technical Requirements and electives may be used to complete an emphasis area in one of the following fields: Applied Fluid Mechanics, Construction, Environmental Engineering, Geotechnical/Geoenvironmental Engineering, Structural Engineering, or Transportation Engineering.

Note: Civil Engineering students may neither enroll in nor receive credit for any C E or E M course unless they have a 2.0 Engineering grade-point ratio and a passing grade in course prerequisites that have a C E or E M designation.

COMPUTER ENGINEERING

Bachelor of Science

Computer engineers have excellent career opportunities in the design and application of hardware and software components for a variety of computer applications. These include mainframe, desktop, and embedded microprocessor platforms, as well as the networking of various types of computers and peripherals.

Based on a strong foundation in mathematics, computer science, and the physical sciences, the Computer Engineering program includes engineering science and design in circuits, electronics, computer organizations and design, peripheral interfacing, and software engineering. Emphasis is placed on hands-on experience with networked computer systems, micro-, mini-, and mainframe computers, and the solution of a wide range of practical problems using engineering principles. In addition to these technical skills, students learn to communicate effectively and to develop interpersonal, teamwork, and management skills, all of which contribute to success in a professional engineering career. The program is also an excellent preparation for graduate study.

Information on the program and its objectives is available at www.clemson.edu/ces/departments/eee/.

Freshman Year

First Semester
- CES 102 Engineering Disciplines and Skills
- CH 101 General Chemistry
- ENGL 103 Accelerated Composition
- MTHSC 106 Calculus of One Variable I
- Arts and Humanities Requirement\(^ \ast \) or
  - Social Science Requirement\(^ \ast \)
16

Second Semester
- ENGR 141 Programming and Problem Solving
- MTHSC 108 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- Arts and Humanities and Requirement\(^ \ast \) or
  - Social Science Requirement\(^ \ast \)
6

Sophomore Year

First Semester
- CP SC 111 Elementary Computer Programming in C/C++
- E C E 201 Logic and Computing Devices
- E C E 202 Electric Circuits I
- E C E 209 Logic and Computing Devices Lab.
- E C E 211 Electrical Engineering Lab. I
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II

Second Semester
- E C E 212 Electrical Engineering Lab. II
- E C E 222 Systems Programming Concepts for Computer Engineering
- E C E 262 Electric Circuits II
- E C E 272 Computer Organization
- E C E 273 Computer Organization Laboratory
- MTHSC 208 Intro. to Ordinary Diff. Equations

Junior Year

First Semester
- E C E 223 Computer Systems Engineering
- E C E 311 Electrical Engineering Lab. III
- E C E 320 Electronics I
- E C E 330 Signals, Systems, and Transforms
- E C E 371 Microcontroller Interfacing
- E C E 372 Microcontroller Interfacing Lab.
- MTHSC 311 Linear Algebra

Second Semester
- E C E 317 Random Signal Analysis
- E C E (CP SC) 322 Intro. to Operating Systems
- E C E 327 Digital Computer Design
- E C E 352 Programming Systems
- MTHSC 419 Discrete Math. Structures I

Senior Year

First Semester
- COMM 150 Intro. to Human Comm. or
- COMM 250 Public Speaking
- E C E 409 Continuous and Discrete Sys. Design
- E C E 495 Integrated System Design I
- ENGL 314 Technical Writing
- Computer Engineering Technical Requirement\(^ \ast \)

Second Semester
- E C E 496 Integrated System Design II
- Arts and Humanities (Literature) Requirement\(^ \ast \)
- Arts and Humanities Requirement\(^ \ast \) or
  - Social Science Requirement\(^ \ast \)
- Computer Engr. Depth. Tech. Requirement\(^ \ast \)

Electrical Engineering

Bachelor of Science

Electrical engineers are in high demand for a wide range of influential positions. Professional duties range from analytical problem solving to the design of components and systems. The scope of employment requires a unique breadth and depth of knowledge and technical skills, which are reflected in the Electrical Engineering program. This program also offers an excellent preparation for graduate education. Detailed information can be found at www.clemson.edu/ces/departments/eee/.

Building on a foundation of mathematical and physical sciences, students progress into the application of these in the engineering science areas of circuits, electronics, communications, controls, power, and electromagnetics. In these subjects, students also begin to apply the concepts and techniques learned to the design of circuits and systems. Senior technical design courses offer the opportunity to further develop expertise in a selected area.

In addition to these technical skills, students learn to communicate effectively, both orally and with the written word. Because engineers work for the benefit of society, the curriculum includes a strong component of humanities and social science courses. Also, many project design assignments enable the development of interpersonal, teamwork, and management skills, which are necessary for success in a professional engineering career.

Freshman Year

First Semester
- CES 102 Engineering Disciplines and Skills
- CH 101 General Chemistry
- ENGL 103 Accelerated Composition
- MTHSC 106 Calculus of One Variable I
- Arts and Humanities Requirement\(^ \ast \) or
  - Social Science Requirement\(^ \ast \)
16

Second Semester
- CH 102 General Chemistry
- ENGR 141 Programming and Problem Solving
- MTHSC 108 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- Arts and Humanities Requirement\(^ \ast \) or
  - Social Science Requirement\(^ \ast \)
17

Notes:
1. A student is allowed to enroll in E C E courses (excluding E C E 507, 508, 509) only when all prerequisites have been passed with a grade of C or better.
2. All Computer Engineering students must have a cumulative engineering grade-point ratio of 2.0 to enroll in any 300- or 400-level E C E courses.
3. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any E C E course.

\(\ast\)See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

\(\ast\)Select from department approved list.

3. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any E C E course.

\(\ast\)Select from ENGL 202, 210, 211, 212, 213, 214, or 215.
**Sophomore Year**

**First Semester**
- 3 - CP SC 111 Elementary Computer Programming in C/C++
- 2 - E C E 201 Logic and Computing Devices
- 3 - E C E 202 Electric Circuits I
- 1 - E C E 209 Logic and Computing Devices Lab.
- 1 - E C E 211 Electrical Engineering Lab. I
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II

**Second Semester**
- 1 - E C E 212 Electrical Engineering Lab. II
- 3 - E C E 262 Electric Circuits II
- 3 - E C E 272 Computer Organization
- 1 - E C E 273 Computer Organization Laboratory
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 3 - Arts and Humanities Requirement
- 1 - Social Science Requirement
- 3 - Electrical Engineering Technical Req.

**Junior Year**

**First Semester**
- 1 - E C E 311 Electrical Engineering Lab. III
- 3 - E C E 320 Electronics I
- 3 - E C E 330 Signals, Systems, and Transforms
- 3 - E C E 371 Microcontroller Interfacing
- 1 - E C E 372 Microcontroller Interfacing Lab.
- 3 - E C E 380 Electromagnetics
- 3 - Advanced Mathematics Requirement

**Second Semester**
- 1 - E C E 312 Electrical Engineering Lab. IV
- 3 - E C E 317 Random Signal Analysis
- 3 - E C E 321 Electronics II
- 3 - E C E 360 Electric Power Engineering
- 3 - E C E 381 Fields, Waves, and Circuits
- 3 - ENGL 314 Technical Writing

**Senior Year**

**First Semester**
- 3 - COMM 150 Intro. to Human Comm. or
- 3 - COMM 250 Public Speaking
- 3 - E C E 409 Continuous and Discrete Syst. Des.
- 3 - E C E 427 Communications Systems
- 2 - E C E 495 Integrated Systems Design I
- 3 - Electrical Engineering Technical Req.

**Second Semester**
- 2 - E C E 496 Integrated System Design II
- 6 - Arts and Humanities Requirement or
- 6 - Social Science Requirement
- 3 - Arts and Humanities Requirement or
- 3 - Social Science Requirement
- 3 - Electrical Engineering Technical Req.
- 3 - Electrical Engineering Technical Req. Depth

**Freshman Year**

**First Semester**
- 2 - CES 102 Engineering Disciplines and Skills
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - Arts and Humanities Requirement or
- 3 - Social Science Requirement

**Second Semester**
- 4 - CH 102 General Chemistry
- 2 - ENGR 130 Engineering Fundamentals
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 3 - Arts and Humanities Requirement or
- 3 - Social Science Requirement

**Sophomore Year**

**First Semester**
- 3 - BIOL 103 General Biology and
- 1 - BIOL 105 General Biology Laboratory or
- 5 - BIOL 110 Principles of Biology
- 3 - C E 201 Statics
- 3 - EE&S 201 Environmental Engineering Fund. I
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II

**Junior Year**

**First Semester**
- 4 - C E 341 Introduction to Fluid Mechanics
- 3 - EE&S 430 Air Pollution Engineering
- 4 - MICRO 305 General Microbiology
- 3 - Arts and Humanities Requirement or
- 3 - Social Science Requirement
- 3 - Statistics Requirement

**Second Semester**
- 3 - EE&S 402 Water and Wastewater Treatment
- 3 - EE&S 484 Municipal Solid Waste Mgt.
- 3 - M E 310 Thermodynamics and Heat Transfer
- 4 - Earth Science Requirement
- 2 - Engineering Economics Requirement
- 3 - Arts and Humanities Requirement or
- 3 - Social Science Requirement

**Senior Year**

**First Semester**
- 1 - EE&S 450 Environ. Engr. Senior Seminar
- 3 - EE&S 480 Environmental Risk Assessment
- 3 - EE&S 486 Pollution Prevention
- 5 - Engineering or Science Requirement
- 3 - Arts and Humanities Requirement or
- 3 - Social Science Requirement

**Second Semester**
- 1 - B E (EE&S) 451 Newman Seminar and Lecture Series in Natural Resources Engineering
- 3 - EE&S 475 Capstone Design Project
- 3 - EE&S 485 Hazardous Waste Management
- 6 - Engineering or Science Requirement

**Notes:**
- Students may enroll in E C E 222 for a common semester with Computer Engineering. Those not selecting this option should complete the Electrical Engineering Technical Requirement in the senior year.
- Select from department-approved list.
- MTHSC 434, 435, 455, or 454
- Notes:
  1. A student is allowed to enroll in E C E courses (excluding E C E 307, 308, 309) only when all prerequisites have been passed with a grade of C or better.
  2. All Electrical Engineering students must have a cumulative engineering grade-point ratio of 2.0 to enroll in any 300- or 400-level E C E courses.
  3. No student may exceed a maximum of two attempts, excluding W, to complete successfully any E C E course.

**ENVIRONMENTAL ENGINEERING**

**Bachelor of Science**

Our complex world faces many challenges, including contaminated water supplies, hazardous wastes, an increasing population and limited resources. Environmental engineers help to solve many of the environmental problems faced by society using the principles of biology, chemistry, physics, mathematics, and earth sciences. An undergraduate degree in Environmental Engineering opens the door to a variety of rewarding career options. Environmental engineers protect water quality by designing water and wastewater treatment systems; ensure public safety by managing solid, hazardous and radioactive wastes; improve air quality by controlling emissions from mobile and stationary sources; reduce human health risks by tracking contaminants as they move through the environment; clean up toxic waste spills and restore historically contaminated sites; and design a more sustainable future by understanding our use of resources.

The curriculum for the Bachelor of Science degree in Environmental Engineering consists of 128-130 credit hours and the Natural Systems Concentration also consists of 128-130 credit hours. The first two years of the program are common for all students enrolled in the degree. In the junior and senior years, students may select a core curriculum that emphasizes areas traditionally associated with environmental engineering, such as water and wastewater management, solid and hazardous waste management, air pollution control, pollution prevention and risk assessment. Alternatively, students entering their junior year may choose the Natural Systems Concentration, which places a greater emphasis on environmental processes in natural environments. All students participate in two professional seminar courses and complete a capstone design project.
See Policy on Humanities and Social Sciences for Engineering Curricula. HIST 124 is required and satisfies the Science and Technology in Society General Education Requirement and three hours of the Social Science General Education Requirement. Three of these credit hours must also satisfy General Education Cross-Cultural Awareness Requirement. Students are encouraged to select PHIL 345 to fulfill the Arts and Humanities (Non-Literature) General Education Requirement.

1E G 209 may be substituted.
2BIOSC 210 may be substituted. Students selecting this option must make up one hour in any manner they choose.
3Select from EX ST 311, GEOL 211 or MTHSC 302.
4Select GEOL 101 and 103, or CSENV 202.
5Select C E 352 or 1 E 384.
6Choose any combination of engineering and/or sciences courses from a department-approved list.

<table>
<thead>
<tr>
<th>NATURAL SYSTEMS CONCENTRATION</th>
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### Freshman Year

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<tr>
<th>First Semester</th>
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<tbody>
<tr>
<td>2 - CES 102 Engineering Disciplines and Skills</td>
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<tr>
<td>4 - CH 101 General Chemistry</td>
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<td>3 - ENGL 103 Accelerated Composition</td>
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<td>4 - MTHSC 106 Calculus of One Variable I</td>
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<td>3 - Arts and Humanities Requirement1 or 3 - Social Science Requirement1</td>
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<tr>
<th>Second Semester</th>
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<tbody>
<tr>
<td>4 - CH 102 General Chemistry</td>
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<td>2 - ENGR 130 Engineering Fundamentals</td>
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<tr>
<td>4 - MTHSC 108 Calculus of One Variable II</td>
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<td>3 - PHYS 122 Physics with Calculus I</td>
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<td>3 - Arts and Humanities Requirement1 or 3 - Social Science Requirement1</td>
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### Sophomore Year

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<tr>
<th>First Semester</th>
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<tbody>
<tr>
<td>3 - BIOL 103 General Biology and</td>
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<td>1 - BIOL 105 General Biology Laboratory or 5 - BIOL 110 Principles of Biology</td>
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<tr>
<td>3 - C E 201 Statics</td>
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<tr>
<td>3 - EE&amp;S 201 Environmental Engineering Fund. I</td>
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<tr>
<td>4 - MTHSC 206 Calculus of Several Variables</td>
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<td>3 - PHYS 221 Physics with Calculus II</td>
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<tr>
<th>Second Semester</th>
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<tbody>
<tr>
<td>4 - CH 201 Survey of Organic Chemistry or 3 - CH 223 Organic Chemistry and</td>
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<tr>
<td>1 - CH 227/Organic Chemistry Laboratory</td>
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<td>2 - C E 208 Dynamics</td>
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<td>2 - E G 210 Comp.-Aided Design and Engr. Apps.2</td>
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<tr>
<td>4 - EE&amp;S 202 Environmental Engineering Fund. II</td>
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<tr>
<td>4 - MTHSC 208 Intro. to Ordinary Diff. Equations</td>
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### Junior Year

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<th>First Semester</th>
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<tbody>
<tr>
<td>4 - C E 341 Introduction to Fluid Mechanics</td>
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<td>4 - CSENV 202 Soils</td>
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<td>4 - MICRO 305 General Microbiology</td>
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<td>3 - Natural Systems Engineering Requirement4</td>
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<td>3-4 - Statistics Requirement</td>
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### Industrial Engineering

#### Bachelor of Science

Industrial engineers design, install, and improve the complex systems that provide goods and services vital to our society and economy. These systems place unique demands for breadth of preparation on industrial engineers. Baccalaureate degree graduates demonstrate the ability to design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy. Graduates demonstrate the ability to apply the principles and techniques of industrial engineering analysis and design supported by a foundation in mathematical, physical, and social sciences, and economic, operational, and engineering analyses. Graduates possess a breadth of knowledge that allows them to practice industrial engineering with an appropriate awareness of information issues in systems improvement. In addition, graduates are able to work and communicate effectively with colleagues at every level in an organization.

The traditional arenas for the practice of industrial engineering are the manufacturing facilities of industry; however, many practicing industrial engineers are employed in non-manufacturing institutions such as hospitals, banks, and government agencies. In addition to numerous employment opportunities in professional practice, industrial engineering graduates may further their formal education. The Department of Industrial Engineering offers programs leading to the Master of Science and Doctor of Philosophy degrees.

The Department of Industrial Engineering allows students to count up to 12 hours of graduate credit (approved 600- and 800-level courses) toward both the bachelor’s and master’s degrees. Students participating in this program must have a minimum grade-point ratio of 3.4 and be admitted to the Graduate School prior to registering for graduate courses. Details of the suggested curriculum and program information are available from the Industrial Engineering Department.

Detailed curriculum and department information is available at www.ces.clemson.edu/ie.

### Freshman Year

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<td>4 - MTHSC 106 Calculus of One Variable I</td>
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### Second Semester

| - E G 209 may be substituted. |
| - BIOSC 210 may be substituted. Students selecting this option must make up one hour in any manner they choose. |
| - Select from EX ST 301, GEOL 211 or MTHSC 302. |
| - Select C E 352 or 1 E 384. |
| - Choose any combination of engineering and/or sciences courses from a department-approved list. |

The Department of Industrial Engineering allows students to count up to 12 hours of graduate credit (approved 600- and 800-level courses) toward both the bachelor’s and master’s degrees. Students participating in this program must have a minimum grade-point ratio of 3.4 and be admitted to the Graduate School prior to registering for graduate courses. Details of the suggested curriculum and program information are available from the Industrial Engineering Department.

Detailed curriculum and department information is available at www.ces.clemson.edu/ie.
Junior Year

First Semester
- C E 208 Dynamics
- I E 360 Ind. Appl. of Probability and Statistics
- I E 368 Professional Practice in I E
- I E 440 Decision Support Systems in I E
- Arts and Humanities Requirement or
- Social Science Requirement
- Mathematics or Natural Science Req.

Second Semester
- COMM 150 Intro. to Human Comm. or
- COMM 250 Public Speaking
- C E 307 Basic Electrical Engineering
- I E 309 Electrical Engineering Lab. I
- I E 361 Industrial Quality Control
- I E 381 Methods of Operational Research II
- I E 386 Production Planning and Control

Senior Year

First Semester
- I E 461 Quality Engineering
- I E 465 Facilities Planning and Design
- I E 482 Systems Modeling
- Engineering Requirement
- Technical Requirement

Second Semester
- I E 467 Systems Design II
- Arts and Humanities Requirement or
- Social Science Requirement
- Management Requirement
- Technical Requirement

Freshman Year

First Semester
- CH 101 General Chemistry
- MTHSC 102 Calculus of One Variable II
- ENGR 141 Programming and Problem Solving
- Arts and Humanities Requirement or
- Social Science Requirement

Second Semester
- E G 208 Engineering Graphics with Computer Applications
- ENGR 141 Programming and Problem Solving
- MTHSC 108 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- PHYS 124 Physics Lab. I
- Arts and Humanities Requirement or
- Social Science Requirement

Sophomore Year

First Semester
- M E 222 Mechanical Engineering Lab. I
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- Science Requirement

Preparation for a 40–45-year professional career requires development of the whole person through a balanced program encompassing the humanities, social sciences, communication and computer skills, physical and engineering sciences, design, and laboratory experience. Students start with the physical sciences and communication skills and progress through the engineering sciences, ultimately applying the principles learned in such areas as energy conversion and transfer, mechanical design, and systems analysis. Throughout the curriculum, the fundamental nature of engineering as a problem-solving discipline is emphasized.

Mechanical Engineering students who have a cumulative grade-point ratio or cumulative engineering grade-point ratio (EGPR) below 2.0 are on probation and will have restricted enrollment in classes. Students whose cumulative grade-point ratio is below 2.0 are subject to the regulations stipulated under Academic Eligibility Policy. Students on probation for EGPR below 2.0 who fail to recover in the first regular semester (fall or spring) will not be allowed to register for mechanical engineering classes. After one year, such students may petition the Mechanical Engineering Department for continued enrollment. An advising policy for students on probation is available from the Mechanical Engineering Department.

Additional information can be found at www.clemson.edu/me.
SCIENCE PROGRAMS
The College of Engineering and Science offers curricula leading to the Bachelor of Science in Chemistry, Computer Information Systems, Computer Science, Geology, Mathematical Sciences, Physics, and Polymer and Fiber Chemistry. The Bachelor of Arts is offered in Chemistry, Computer Science, Geology, Mathematical Sciences, and Physics.

The science departments in the College work closely with the other academic departments in the University, including such disciplines as economics and management as well as engineering. This allows students in the sciences great flexibility and responsibility in designing their own programs.

Bachelor of Science Curricula
The Bachelor of Science degree prepares graduates for professional employment or graduate study in the chosen science discipline. BS curricula are more highly structured than BA curricula but nonetheless offer opportunity for students to pursue a minor or secondary area of interest.

Bachelor of Arts Curricula
The curricula leading to the Bachelor of Arts degree are designed to meet the needs of students who desire a broad general education. They require a minor (or a second major) as well as the major concentration. A major requires a minimum of 24 credits from courses above the sophomore level, including or in addition to courses specified by the major department. In some major disciplines, certain prescribed courses at the sophomore level are counted toward the 24-credit requirement.

Students have a large degree of flexibility and responsibility in selecting a minor from those listed on page 106. Courses for these minors are to be selected in consultation with the appropriate department.

CHEMISTRY
Bachelor of Science
Chemistry, an experimental discipline based on observation guided by molecular theory, is of fundamental importance in much of modern science and technology. Its molecular concepts form the basis for ideas about complex material behavior. Due to the fundamental nature and extensive application of chemistry, an unusually large variety of challenging opportunities to contribute in the science-oriented community are open to students whose education is built around the principles of this discipline.

The Chemistry curriculum, through the career requirement options and the large number of electives, provides students the opportunity to select a coherent program of study beyond the basic courses. Career requirement options are provided for students anticipating graduate study in chemistry or related fields; employment following the BS degree in laboratory, production, technical sales, or management positions; professional studies (e.g., medicine); chemical physics; geochemistry; and employment in fields requiring extensive preparation in courses other than sciences (e.g., patent law and technical writing). Significant features of the curriculum are the student’s extensive participation in experimental work and the opportunity to take part in a research investigation during the junior and senior years.

Freshman Year
First Semester
4 - CH 101 General Chemistry
1 - CH 141 Chemistry Orientation
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
   — 3 - Social Science Requirement1
   — 15
Second Semester
4 - CH 102 General Chemistry
2 - CH 152 Chemistry Communication I
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
   — 3 - Social Science Requirement1
   — 16
Sophomore Year
First Semester
3 - CH 223 Organic Chemistry
1 - CH 227 Organic Chemistry Lab.
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. II
4 - Foreign Language Requirement2
   — 16
Second Semester
3 - CH 205 Introduction to Inorganic Chemistry
3 - CH 224 Organic Chemistry
1 - CH 228 Organic Chemistry Lab.
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - PHYS 222 Physics with Calculus III
1 - PHYS 224 Physics Lab. III
15
Junior Year
First Semester
3 - BIOC 301 Molecular Biochemistry or
3 - BIOC 305 Essential Elements of Bioch.
3 - CH 313 Quantitative Analysis
2 - CH 315 Quantitative Analysis Lab.
3 - CH 331 Physical Chemistry
1 - CH 339 Physical Chemistry Lab.
3 - ENGL 314 Technical Writing
   — 15
Second Semester
3 - CH 332 Physical Chemistry
1 - CH 340 Physical Chemistry Lab.
3 - CH 411 Instrumental Analysis
2 - CH 412 Instrumental Analysis Lab.
3 - Arts and Humanities (Literature) Requirement1
3 - Elective
   — 15
Senior Year
Second Semester
3 - CH 402 Inorganic Chemistry
2 - CH 403 Advanced Synthintic Techniques
3 - CH 443 Research Problems
3 - Arts and Humanities Requirement1 or
   — 3 - Social Science Requirement1
3 - Chemistry Requirement1
14
First Semester
3 - CH 444 Research Problems
3 - CH 452 Chemistry Capstone
1 - CH 452 Chemistry Communication II
3 - Arts and Humanities Requirement1 or
   — 3 - Social Science Requirement1
3 - Chemistry Requirement1
   — 3 - Elective
   — 16
122 Total Semester Hours
1See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.
2One semester (through 102) in any modern foreign language is required.
3See advisor.

CHEMISTRY
Bachelor of Arts
Freshman Year
First Semester
4 - CH 101 General Chemistry
1 - CH 141 Chemistry Orientation
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
   — 3 - Social Science Requirement1
   — 15
Second Semester
4 - CH 102 General Chemistry
2 - CH 152 Chemistry Communication I
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
   — 3 - Social Science Requirement1
   — 16
Sophomore Year
First Semester
3 - CH 223 Organic Chemistry
1 - CH 227 Organic Chemistry Lab.
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. II
4 - Foreign Language Requirement2
   — 16
Second Semester
3 - CH 205 Introduction to Inorganic Chemistry
3 - CH 224 Organic Chemistry
1 - CH 228 Organic Chemistry Lab.
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - PHYS 222 Physics with Calculus III
1 - PHYS 224 Physics Lab. III
15
Junior Year
First Semester
3 - BIOC 301 Molecular Biochemistry or
3 - BIOC 305 Essential Elements of Bioch.
3 - CH 313 Quantitative Analysis
2 - CH 315 Quantitative Analysis Lab.
3 - CH 331 Physical Chemistry
1 - CH 339 Physical Chemistry Lab.
3 - ENGL 314 Technical Writing
   — 15
Second Semester
3 - CH 332 Physical Chemistry
1 - CH 340 Physical Chemistry Lab.
3 - CH 411 Instrumental Analysis
2 - CH 412 Instrumental Analysis Lab.
3 - Arts and Humanities (Literature) Requirement1
3 - Elective
   — 15
Senior Year
Second Semester
3 - CH 402 Inorganic Chemistry
2 - CH 403 Advanced Synthetic Techniques
3 - CH 443 Research Problems
3 - Arts and Humanities Requirement1 or
   — 3 - Social Science Requirement1
3 - Chemistry Requirement1
14
First Semester
3 - CH 444 Research Problems
3 - CH 452 Chemistry Capstone
1 - CH 452 Chemistry Communication II
3 - Arts and Humanities Requirement1 or
   — 3 - Social Science Requirement1
3 - Chemistry Requirement1
   — 3 - Elective
   — 16
122 Total Semester Hours
1See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.
2One semester (through 102) in any modern foreign language is required.
3See advisor.
Junior Year
First Semester
3 - CH 313 Quantitative Analysis
1 - CH 317 Quantitative Analysis Lab.
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Arts and Humanities (Literature) Requirement1
3 - Foreign Language Requirement2
3 - Minor Requirement
16
Second Semester
3 - CH 331 Physical Chemistry
3 - ENGL 314 Technical Writing
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Foreign Language Requirement2
3 - Minor Requirement
15
Senior Year
First Semester
3 - CH 332 Physical Chemistry
3 - Chemistry Requirement3
3 - Minor Requirement
6 - Elective
15
Second Semester
3 - CH 450 Chemistry Capstone
1 - CH 452 Chemistry Communication II
3 - Chemistry Requirement3
6 - Minor Requirement
13
122 Total Semester Hours

3 - MTHSC 108 Calculus of One Variable I
4 - MTHSC 106 Calculus of One Variable II
15
Second Semester
4 - CP SC 102 Computer Science II
3 - MTHSC 207 Multivariable Calculus1 and
1 - Elective3 or
4 - MTHSC 108 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement1
3 - Natural Science Requirement2
3 - Social Science Requirement1
17
Sophomore Year
First Semester
3 - CP SC 207 Discrete Structures for Computing
4 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement3
3 - Oral Communication Requirement3
3 - Social Science Requirement1
16
Second Semester
3 - CP SC 215 Software Development Foundations
4 - CP SC 231 Intro. to Computer Organization
1 - CP SC 291 Seminar in Professional Issues I
3 - MGT 201 Principles of Management
3 - Probability and Statistics Requirement4
14
Junior Year
First Semester
3 - ACCT 201 Financial Accounting Concepts
3 - CP SC 322 Introduction to Operating Systems
3 - CP SC 372 Introduction to Software Engineering
3 - MTHSC 311 Linear Algebra
3 - Writing Requirement3
15
Second Semester
3 - ACCT 202 Managerial Accounting Concepts
3 - CP SC 360 Networks and Network Program.
3 - CP SC 371 Systems Analysis or
3 - MGT 452 Systems Analysis and Design
3 - ECON 211 Principles of Microeconomics
3 - Computer Science Requirement6
15
Senior Year
First Semester
3 - CP SC 420 Computer Security Principles or
3 - CP SC 424 System Admin. and Security
3 - CP SC 462 Database Management Systems
3 - CP SC 491 Seminar in Professional Issues II
3 - Business Requirement7
3 - Computer Science Requirement6
15
Second Semester
3 - MGT 312 Decision Models for Management
3 - MKT 301 Principles of Marketing
3 - Business Requirement1
3 - Computer Science Requirement6
3 - Information Systems Requirement6
15
122 Total Semester Hours

1 - Elective1
2Select from courses in BIOL, BIOCH, BIOSC, CH, GEOL, MICRO, PHYS, or EN SP 200. At least one course must include a laboratory and satisfy the Natural Science General Education Requirement.
2See General Education Requirements.
3MTHSC 301, 302, or 309.
4Select from School-approved list.
5Select from 300-level or higher CP SC courses. No more than six credits of CP SC 481 may be used.
6Select from MGT 390, 400, FIN 306.
7Select from MGT 452, 454, 455, 456, or 400-level CP SC courses. CP SC 481 may not be used.
8Select either the MTHSC 102/207 or 106/108 sequence. Students who select the 106/108 sequence will have satisfied the two elective credits in the freshman year.
9Select from courses in BIOL, BIOCH, BIOSC, CH, GEOL, MICRO, PHYS, or EN SP 200. At least one course must include a laboratory and satisfy the Natural Science General Education Requirement.
10See General Education Requirements.
11See CAC of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 547-7700. Additional information can be found at www.cs.clemson.edu.

COMPUTER INFORMATION SYSTEMS
Bachelor of Science
The Computer Science program is oriented toward design, implementation, and application of software systems to solve information processing problems. Emphasis areas outside computer science allow students to tailor the program to their individual needs and interests. This program is more technically oriented than the Computer Information Systems curriculum. It prepares students for employment in the computer software field or for continued study toward an advanced degree in computer science. This program is accredited by the Computing Accreditation Commission (CAC) of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 547-7700. Additional information can be found at www.cs.clemson.edu.

Students who change majors into Computer Science must have a cumulative grade-point ratio of 2.0 or higher.

Combined Bachelor’s/Master’s Plan
The School of Computing allows students to count up to nine hours of graduate credit (600- and 800-level courses) toward both the bachelor’s and master’s degrees. Students participating in this program must have a minimum grade-point ratio of 3.4 and be admitted to the Graduate School prior to registering for graduate courses. Details of the suggested curriculum and program information are available from the Department.
Freshman Year
First Semester
1 - CP SC 101 Computer Science I
2 - ENGL 103 Accelerated Composition
3 - MTHSC 106 Calculus of One Variable I
4 - Natural Science Requirement
15
Second Semester
1 - CP SC 102 Computer Science II
2 - MTHSC 108 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement
4 - CP SC 481 Seminar in Professional Issues I
5 - Fine Arts Requirement
12 Total Semester Hours

Sophomore Year
First Semester
1 - CP SC 207 Discrete Structures for Computing
2 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement
4 - Natural Science Requirement
5 - Oral Communication Requirement
16
Second Semester
1 - CP SC 215 Software Development Foundations
2 - CP SC 231 Intro. to Computer Organization
1 - CP SC 291 Seminar in Professional Issues I
2 - Probability and Statistics Requirement
3 - Foreign Language Requirement
1 Select from courses in A A H, ANTH, ART, CHIN, COMM, DANCE, E A S, ECON, ENGL, FR, GEOG, GER, HIST, HUM, ITAL, JPN, MUSIC, P A, P A S, PHIL, PO SC, PSYCH, REL, RUSS, SOC, SPAN, THEA, W S.
2 Four semesters (through 202) in the same modern foreign language are required.
3 Select either the MTHSC 102/207 or 106/108 sequence. Students who select the 106/108 sequence will have satisfied the two elective credits in the freshman year. Students interested in computer graphics should select the 106/108 sequence.
4 Select from School-approved list.

Junior Year
First Semester
1 - CP SC 301 Computer Systems Organization
2 - CP SC 360 Networks and Network Program
3 - CP SC 372 Introduction to Software Engineering
4 - MTHSC 311 Linear Algebra
5 - Social Science Requirement
6 - Computer Science Requirement
3 Select from 300-level or higher CP SC courses. No more than six credits of CP SC 481 may be applied to this requirement.
4 Select from approved 300-level or higher MTHSC or E C E courses may be substituted.
5 Select from School-approved list.

Second Semester
1 - CP SC 322 Introduction to Operating Systems
2 - CP SC 350 Foundations of Computer Science
3 - CP SC 362 Distributed and Cluster Computing
4 - Arts and Humanities Requirement
5 - Social Science Requirement
6 - Social Science Requirement
15

Senior Year
First Semester
1 - CP SC 330 Computer Systems Organization
2 - CP SC 360 Networks and Network Program
3 - CP SC 372 Introduction to Software Engineering
4 - MTHSC 311 Linear Algebra
5 - Social Science Requirement
6 - Social Science Requirement
15
Second Semester
1 - CP SC 491 Seminar in Professional Issues II
2 - Arts and Humanities Requirement
3 - Social Science Requirement
4 - Computer Science Requirement
5 - Computer Science Requirement
12 Total Semester Hours

Second Semester
1 - CP SC 215 Software Development Foundations
2 - CP SC 231 Intro. to Computer Organization
1 - CP SC 291 Seminar in Professional Issues I
2 - Foreign Language Requirement
3 - Natural Science Requirement
Second Year
First Semester
1 - CP SC 301 Computer Systems Organization
2 - CP SC 360 Networks and Network Program
3 - CP SC 372 Introduction to Software Engineering
4 - MTHSC 311 Linear Algebra
5 - Social Science Requirement
6 - Computer Science Requirement
7 - Minor Requirement
8 - Computer Science Requirement
15
Second Semester
1 - CP SC 322 Introduction to Operating Systems
2 - CP SC 350 Foundations of Computer Science
3 - CP SC 362 Distributed and Cluster Computing
4 - Arts and Humanities Requirement
5 - Social Science Requirement
6 - Minor Requirement
7 - Elective
15

121 Total Semester Hours

Notes:
1. For graduation, a candidate for the BA degree in Computer Science must have earned a grade of C or better in each CP SC course applied to the degree.
2. A grade of C or better must be earned in all prerequisite courses (including CP SC and MTHSC courses) before enrolling in the next CP SC course.

COMPUTER SCIENCE
Bachelor of Arts
The Bachelor of Arts in Computer Science is ideal for students interested in acquiring a broad-based liberal arts education that includes a strong and solid understanding of computer science. The curriculum is oriented toward design, implementation, and application of computer software systems to solve information processing problems. The program prepares students for employment in the computer software field or for continued study toward an advanced degree in computer science. Additional information can be found at www.cs.clemson.edu.

Students who change majors into Computer Science must have a cumulative grade-point ratio of 2.0 or higher.

Freshman Year
First Semester
1 - CP SC 101 Computer Science I
2 - ENGL 103 Accelerated Composition
3 - MTHSC 102 Intro, to Mathemat. Analysis and 1 - Elective
4 - MTHSC 106 Calculus of One Variable I
5 - Foreign Language Requirement
15
Second Semester
1 - CP SC 102 Computer Science II
2 - MTHSC 108 Calculus of One Variable II
1 - Elective
3 - Arts and Humanities (Non-Lit.) Req.
4 - Foreign Language Requirement
15

Sophomore Year
First Semester
1 - CP SC 207 Discrete Structures for Computing
2 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement
4 - Foreign Language Requirement
5 - Oral Communication Requirement
16

Second Semester
1 - CP SC 215 Software Development Foundations
2 - CP SC 231 Intro. to Computer Organization

College of Engineering and Science
GEOLOGY

Bachelor of Science

Geology and biogeochemical environmental science involve the physics and chemistry of materials that comprise the earth, as well as the development and influence of life on earth and the environmental systems and processes involved. The chemical, physical, and biological responses to environments on and in the earth must be thoroughly understood at a fundamental level so that the history of the earth can be deduced, future changes and natural disasters might be predicted, and sustainable approaches to natural resources developed. We depend on many geological resources; for example, water from ground and surface systems, metals from minerals, and power from coal, petroleum, and radioactive minerals. Geology integrates the science and engineering principles used for understanding and managing these geological and environmental systems. The Geology curriculum is built around three themes in geology and environmental science: appreciation for spatial and temporal scales, knowledge of earth materials and compositions of environmental systems, and understanding geological and environmental processes. The Bachelor of Science degree can be earned in traditional geology or with a concentration in Hydrogeology or Environmental Science. All majors participate in an interdisciplinary problem-oriented group research sequence and capstone course.

Employment opportunities for geologists and environmental scientists are numerous and varied. Included are such far-reaching fields as environmental and engineering consulting firms, mineral-producing industries, railroads, municipalities, natural resources conservation organizations, and water authorities. Many students go on to graduate study. It is important, therefore, that a geology or biogeochemical environmental science education develop a broad and rigorous base integrating a variety of descriptive and quantitative material.

The "traditional" curriculum provides the fundamentals of geology and excellent support in basic sciences. Graduates are prepared for employment or for graduate study in any field of geology. The Environmental Science Concentration provides an appropriate quantitative science base for students interested in environmental science and an introduction to environmental systems. It prepares students for careers in natural resources, the environmental consulting industry, government agencies or graduate school in environmental fields. The Hydrogeology Concentration may be taken by students interested in surface and groundwater systems and applying engineering principles to geologic problems. Graduates from the Hydrogeology Concentration work for consulting companies, government agencies and in the natural resources area or go on to graduate study.

Freshman Year

First Semester
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
3 - GEOL 101 Physical Geology
1 - GEOL 103 Physical Geology Lab.
4 - MTHSC 106 Calculus of One Variable I

Sophomore Year

First Semester
3 - BIOL 103 General Biology I
1 - BIOL 105 General Biology Lab. I
3 - GEOL 205 Mineralogy and Intro. Petrology
2 - GEOL 208 Min. and Intro. Petrography Lab.
4 - GEOL 211 Geoanalysis I
1 - GEOL 291 Introduction to Research I
1 - Elective
15

Second Semester
4 - CSENV 202 Soils
4 - GEOL 212 Geoanalysis II
1 - GEOL 292 Introduction to Research II
3 - PHYS 122 Physics with Calculus I
3 - Social Science Requirement
15

Junior Year

First Semester
3 - EN SP 200 Intro. to Environmental Science
4 - GEOL 302 Structural Geology
3 - GEOL 316 Igneous and Metamorphic Petrology
2 - GEOL 391 Research Methods I
3 - Arts and Humanities (Literature) Requirement
15

Second Semester
3 - GEOL 300 Environmental Geology
4 - GEOL 313 Sedimentology and Stratigraphy
2 - GEOL 392 Research Methods II
3 - Geology Requirement
2 - Elective
17

Summer
6 - Summer Geology Field Course

Senior Year

First Semester
4 - GEOL 405 Surficial Geology
3 - GEOL 408 Geohydrology
3 - GEOL 491 Research Synthesis I
2 - Elective
12

Second Semester
4 - GEOL 409 Subsurface Methods
3 - GEOL 492 Research Synthesis II
3 - Geology Requirement
2 - Elective
12

Summer
3 - Field Experience

See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Requirement.

MTHSC 206 and 208 or 301 or EX ST 301 may be substituted.

Select from department-approved list.

ENVIRONMENTAL SCIENCE CONCENTRATION

Freshman Year

First Semester
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
3 - GEOL 101 Physical Geology
1 - GEOL 103 Physical Geology Lab.
4 - MTHSC 106 Calculus of One Variable I
15

Second Semester
4 - CH 102 General Chemistry
4 - GEOL 102 Earth History
4 - MTHSC 108 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement
15

Sophomore Year

First Semester
3 - BIOL 103 General Biology I
1 - BIOL 105 General Biology Lab. I
3 - GEOL 205 Mineralogy and Intro. Petrology
1 - GEOL 207 Mineral. and Intro. Petrology Lab.
4 - GEOL 211 Geoanalysis I
1 - GEOL 291 Introduction to Research I
3 - Arts and Humanities (Non-Lit.) Requirement
3 - Geology Requirement
16

Second Semester
3 - GEOL 300 Environmental Geology
4 - GEOL 313 Sedimentology and Stratigraphy
2 - GEOL 392 Research Methods II
3 - Geology Requirement
3 - Social Science Requirement
2 - Elective
17

Junior Year

First Semester
3 - EN SP 200 Intro. to Environmental Science
4 - GEOL 302 Structural Geology
3 - GEOL 316 Igneous and Metamorphic Petrology
2 - GEOL 391 Research Methods I
3 - Arts and Humanities (Literature) Requirement
15

Second Semester
3 - BIOL 104 General Biology II
1 - BIOL 106 General Biology Lab. II
3 - GEOL 205 Mineralogy and Intro. Petrology
1 - GEOL 207 Mineral. and Intro. Petrology Lab.
4 - GEOL 211 Geoanalysis II
1 - GEOL 292 Introduction to Research II
3 - GEOL 300 Environmental Geology
3 - PHYS 122 Physics with Calculus I
15

Summer
6 - Summer Geology Field Course

Senior Year

First Semester
3 - EN SP 200 Intro. to Environmental Science
2 - GEOL 391 Research Methods I
9 - Environmental Science Requirement
3 - Social Science Requirement
17

Second Semester
3 - GEOL 316 Introduction to Geochemistry
2 - GEOL 392 Research Methods II
9 - Environmental Science Requirement
3 - Social Science Requirement
17

Summer
3 - Field Experience
### Bachelor of Arts

#### Freshman Year

**First Semester**
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 3 - GEO 101 Physical Geology
- 1 - GEOL 103 Physical Geology Lab.
- 4 - MTHSC 106 Calculus of One Variable I  

15

**Second Semester**
- 4 - CH 102 General Chemistry
- 4 - GEO 102 Earth History
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - Arts and Humanities (Non-Lit.) Requirement²

15

#### Sophomore Year

**First Semester**
- 3 - GEO 205 Mineralogy and Intro. Petrology
- 1 - GEO 207 Mineral and Intro. Petrology Lab.
- 4 - GEO 211 Geoanalysis I²
- 1 - GEO 291 Introduction to Research I
- 3 - Arts and Humanities (Literature) Requirement¹
- 3 - Technical Requirement³

15

**Second Semester**
- 4 - GEO 212 Geoanalysis II²
- 1 - GEO 292 Introduction to Research II
- 3 - Arts and Humanities (Literature) Requirement¹
- 3 - Technical Requirement³

14

#### Junior Year

**First Semester**
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 3 - GEO 101 Physical Geology
- 1 - GEO 103 Physical Geology Lab.
- 3 - Mathematics Requirement¹

14

**Second Semester**
- 4 - CH 102 General Chemistry
- 4 - GEOG 103 World Regional Geography
- 4 - GEO 102 Earth History
- 3 - Mathematics Requirement¹
- 2 - Elective

16

#### Senior Year

**First Semester**
- 3 - EN SP 400 Studies in Environmental Science
- 3 - GEO 408 Geohydrology
- 3 - GEO 491 Research Synthesis I
- 3 - Technical Requirement³

15

**Second Semester**
- 3 - GEOL 300 Environmental Geology
- 3 - Geology Requirement⁴
- 3 - Social Science Requirement²
- 3 - Technical Requirement³

15

**Summer**
- 6 - GEOL 475 Summer Geology Field Camp

12

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**GEOLOGY**

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**Freshman Year**

**First Semester**
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 3 - GEO 101 Physical Geology
- 1 - GEOL 103 Physical Geology Lab.
- 4 - MTHSC 106 Calculus of One Variable I

15

**Second Semester**
- 4 - CH 102 General Chemistry
- 4 - GEO 102 Earth History
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - Arts and Humanities (Non-Lit.) Requirement²

15

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**Sophomore Year**

**First Semester**
- 3 - GEO 205 Mineralogy and Intro. Petrology
- 1 - GEO 207 Mineral and Intro. Petrology Lab.
- 4 - GEO 211 Geoanalysis I²
- 1 - GEO 291 Introduction to Research I
- 3 - Arts and Humanities (Literature) Requirement¹
- 3 - Technical Requirement³

15

**Second Semester**
- 4 - GEO 212 Geoanalysis II²
- 1 - GEO 292 Introduction to Research II
- 3 - Arts and Humanities (Literature) Requirement¹
- 3 - Technical Requirement³

14

**Second Semester**
- 4 - CH 102 General Chemistry
- 4 - GEOG 103 World Regional Geography
- 4 - GEO 102 Earth History
- 3 - Mathematics Requirement¹
- 2 - Elective

16

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**Senior Year**

**First Semester**
- 3 - EN SP 400 Studies in Environmental Science
- 3 - GEO 408 Geohydrology
- 3 - GEO 491 Research Synthesis I
- 3 - Technical Requirement³

15

**Second Semester**
- 3 - GEOL 300 Environmental Geology
- 3 - Geology Requirement⁴
- 3 - Social Science Requirement²
- 3 - Technical Requirement³

15

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**College of Engineering and Science**
# MATHEMATICAL SCIENCES

## Bachelor of Science

The Mathematical Sciences curriculum is designed to be versatile. Students gain a broad knowledge of mathematical concepts and methods that are applicable in sciences, engineering, business, industry, and other professions requiring a strong mathematical background. In addition to the basic courses which provide necessary mathematical skills, the curriculum allows students to select an emphasis area or concentration, providing an introduction to a specific area where mathematics is used. These are Abstract Mathematics, Actuarial Science/Financial Mathematics, Applied and Computational Mathematics, Biology, Computer Science, Operations Research/Management Science, and Statistics.

In addition to the overall goal of preparing students to cope with a variety of mathematical problems, the curriculum seeks to provide an adequate background for students who plan to pursue graduate study or positions in business, industry, or government. Students electing the Biology Concentration will have the necessary preparation for entering medical school. More information about the degree program can be found at www.math.clemson.edu.

All mathematical sciences majors are required to complete a capstone experience which provides an opportunity to pursue research, independent study, or an approved internship under the direction of a faculty member, or the opportunity to study mathematical models in some area of the mathematical sciences. The capstone experience requires a written report (thesis, computer code, project description, intern experience, etc.) and an oral or poster presentation by each student.

## Combined Bachelor's/Master's Plan

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 pursuing the dual degree from the Department of Mathematical Sciences (www.math.clemson.edu) as early as possible in their undergraduate program. Enrollment guidelines and procedures can be found under Academic Regulations in this catalog.

## Freshman Year

<table>
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<tr>
<th>Semester</th>
<th>First Semester</th>
<th>Second Semester</th>
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<tbody>
<tr>
<td>Freshman Year</td>
<td>3 - ECON 211 Principles of Microeconomics</td>
<td>4 - MTHSC 106 Calculus of One Variable I</td>
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<td>3 - ENGL 103 Accelerated Composition</td>
<td>3 - Arts and Humanities (Non-Lit.) Requirement</td>
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<td>4 - MTHSC 106 Calculus of One Variable I</td>
<td>3 - Arts and Humanities (Non-Lit.) Requirement</td>
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<td>3 - Fine Arts</td>
<td>3 - Arts and Humanities (Non-Lit.) Requirement</td>
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<td>3 - Foreign Language Requirement</td>
<td>3 - Arts and Humanities (Non-Lit.) Requirement</td>
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## Sophomore Year

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<th>First Semester</th>
<th>Second Semester</th>
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<tbody>
<tr>
<td>Sophomore Year</td>
<td>4 - MTHSC 206 Calculus of Several Variables</td>
<td>4 - MTHSC 208 Intro. to Ordinary Diff. Equations</td>
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<td>1 - MTHSC 250 Intro. to Mathematical Sciences</td>
<td>3 - MTHSC 302 Statistics for Science and Engr.</td>
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<td>3 - MTHSC 311 Linear Algebra</td>
<td>3 - Arts and Humanities (Literature) Requirement</td>
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<td>3 - MTHSC 360 Intermediate Math. Computing</td>
<td>4 - Natural Science Requirement</td>
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<td>4 - Natural Science Requirement</td>
<td>3 - Elective</td>
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## Junior Year

<table>
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<tr>
<th>Semester</th>
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<th>Second Semester</th>
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<tbody>
<tr>
<td>Junior Year</td>
<td>3 - ENGL 314 Technical Writing</td>
<td>3 - MTHSC 412 Introduction to Modern Algebra</td>
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<td>3 - MTHSC 400 Theory of Probability</td>
<td>3 - MTHSC 454 Advanced Calculus II</td>
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<td></td>
<td>3 - MTHSC 443 Advanced Calculus I</td>
<td>3 - Emphasis Area Requirement</td>
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<td>3 - Science Requirement</td>
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## Senior Year

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<th>Second Semester</th>
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<tbody>
<tr>
<td>Senior Year</td>
<td>3 - COMM 250 Public Speaking</td>
<td>3 - MTHSC 492 Professional Development</td>
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<td>3 - Capstone Experience</td>
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<td>6 - Emphasis Area Requirement</td>
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<td>3 - Science and Tech. in Society Requirement</td>
<td>3 - Mathematical Sciences Requirement</td>
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<td>3 - Elective</td>
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</table>

122 Total Semester Hours

1See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Requirement.

2Three credits in any foreign language, including American Sign Language, numbered 102 or above

3CP SC 101, 111, or 120

4A two-semester sequence selected from BIOL 103/105 and 104/106; CH 101 and 102; PHYS 221/223 and 222/224; GEOL 101/103 and 102

5ECON 314 and 405; CP SC 102 and 212; CP SC 210 and 212; or any two natural science courses from General Education Natural Science Requirements (labs not required).

6Any 400-level MTHSC course approved by advisor

7Any 400-level CP SC course

8ECON 405 or any mathematics course approved by advisor.

9Any 400-level CP SC course

## BIOLOGY CONCENTRATION

### Freshman Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>First Semester</th>
<th>Second Semester</th>
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<tbody>
<tr>
<td>Freshman Year</td>
<td>5 - BIOL 110 Principles of Biology I</td>
<td>4 - MTHSC 106 Calculus of One Variable I</td>
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<td>5 - ENGL 103 Accelerated Composition</td>
<td>3 - Foreign Language Requirement</td>
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</table>
## Bachelor of Arts

### Freshman Year

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<tr>
<td>First Semester</td>
<td>3 - ECON 200 Economic Concepts or 3 - ECON 211 Principles of Microeconomics 3 - MTHSC 206 Calculus of Several Variables 1 - MTHSC 250 Intro to Mathematical Sciences 3 - PHYS 207 General Physics I 1 - PHYS 209 General Physics I Lab.</td>
</tr>
<tr>
<td>Second Semester</td>
<td>4 - CH 101 General Chemistry 3 - ECON 200 Economic Concepts or 3 - MTHSC 311 Linear Algebra 3 - PHYS 208 General Physics II 1 - PHYS 210 General Physics II Lab.</td>
</tr>
</tbody>
</table>

### Sophomore Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Semester</td>
<td>3 - CH 223 Organic Chemistry 1 - CH 227 Organic Chemistry Lab. 3 - ENGL 314 Technical Writing 3 - MTHSC 360 Intermediate Math. Computing 3 - MTHSC 440 Linear Programming 3 - Arts and Humanities (Literature) Requirement¹</td>
</tr>
<tr>
<td>Second Semester</td>
<td>3 - CH 224 Organic Chemistry 1 - CH 228 Organic Chemistry Lab. 3 - COMM 250 Public Speaking 3 - MTHSC 302 Statistics for Science and Engr. 3 - Arts and Humanities (Non-Lit.) Requirement³ 3 - Math Science Requirement⁵</td>
</tr>
</tbody>
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### Junior Year

<table>
<thead>
<tr>
<th>Semester</th>
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<tbody>
<tr>
<td>First Semester</td>
<td>3 - MTHSC 400 Theory of Probability 3 - MTHSC 453 Advanced Calculus I or 3 - MTHSC 463 Mathematical Analysis I 3 - Animal or Plant Diversity Requirement⁶ 3 - Capstone Experience⁷ 3 - Social Science Requirement⁷</td>
</tr>
<tr>
<td>Second Semester</td>
<td>3 - MTHSC 412 Introduction to Modern Algebra 3 - MTHSC 454 Advanced Calculus II 1 - MTHSC 492 Professional Development 3 - Biological Sciences Requirement³ 3 - Capstone Experience⁷</td>
</tr>
<tr>
<td>Senior Year</td>
<td>3 - MTHSC 400 Theory of Probability 3 - MTHSC 453 Advanced Calculus I or 3 - MTHSC 463 Mathematical Analysis I 3 - Animal or Plant Diversity Requirement⁶ 3 - Capstone Experience⁷</td>
</tr>
</tbody>
</table>

### Senior Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Details</th>
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</thead>
<tbody>
<tr>
<td>First Semester</td>
<td>3 - MTHSC 206 Calculus of Several Variables 1 - MTHSC 250 Intro. to Mathematical Sciences 3 - MTHSC 360 Intermed. Math. Computing or 3 - EDSEC 437 Technology in Sec. Math. 3 - Arts and Humanities (Literature) Requirement¹ 3 - Elective</td>
</tr>
<tr>
<td>Second Semester</td>
<td>3 - MTHSC 208 Calculus of Several Variables 3 - MTHSC 212 Linear Equations 3 - MTHSC 311 Linear Algebra 3 - Arts and Humanities (Non-Lit.) Requirement⁶ 3 - Minor Requirement⁸ or 3 - Second Major Requirement</td>
</tr>
<tr>
<td>Junior Year</td>
<td>3 - ENGL 314 Technical Writing 3 - MTHSC 412 Introduction to Modern Algebra 3 - Math Science Requirement³ 3 - Natural Science Requirement³ 3 - Elective</td>
</tr>
</tbody>
</table>

### Mathematical Sciences

**Bachelor of Arts**

**Freshman Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Semester</td>
<td>3 - ECON 200 Economic Concepts or 3 - ECON 211 Principles of Microeconomics 3 - MTHSC 206 Calculus of Several Variables 1 - MTHSC 250 Intro. to Mathematical Sciences 3 - PHYS 207 General Physics I 1 - PHYS 209 General Physics I Lab.</td>
</tr>
<tr>
<td>Second Semester</td>
<td>4 - CH 101 General Chemistry 3 - ECON 200 Economic Concepts or 3 - MTHSC 311 Linear Algebra 3 - PHYS 208 General Physics II 1 - PHYS 210 General Physics II Lab.</td>
</tr>
</tbody>
</table>

**Sophomore Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Semester</td>
<td>4 - MTHSC 108 Calculus of One Variable II 3 - MTHSC 129 Prob. Solving in Discrete Math. 3 - Computer Science Requirement² 3 - Foreign Language Requirement¹ 3 - Elective</td>
</tr>
<tr>
<td>Second Semester</td>
<td>4 - MTHSC 108 Calculus of One Variable II 3 - MTHSC 129 Prob. Solving in Discrete Math. 3 - Computer Science Requirement² 3 - Foreign Language Requirement¹ 3 - Elective</td>
</tr>
<tr>
<td>Junior Year</td>
<td>3 - MTHSC 454 Advanced Calculus II 3 - MTHSC 412 Introduction to Modern Algebra 3 - Math Science Requirement³ 3 - Natural Science Requirement³ 3 - Elective</td>
</tr>
</tbody>
</table>

### Physics

**Bachelor of Science**

Physics, the most fundamental of the natural sciences, forms the basis of study upon which the other branches of science are founded. Physics is concerned with the fundamental behavior of matter and energy. Classical physics encompasses the fields of mechanics, heat and thermodynamics, electricity and magnetism, acoustics and optics. Modern physics is concerned with the study of atoms and molecules, atomic nuclei, elementary particles and the properties of liquids, crystalline solids, and other materials, as well as the areas of relativity, cosmology, and the large-scale structure of the universe.
The undergraduate Physics curricula provide students with a strong background in the classical areas of physics, as well as an introduction to the more important aspects of modern physics. The BS curriculum is directed toward preparing students for graduate study ultimately leading to the PhD degree or toward research and development work in industrial or governmental laboratories. It also provides a good background for graduate study or industrial work in many areas or engineering physics and applied science.

**Freshman Year**

**First Semester**
- PHYS 121 Introduction to Calculus I
- PHYS 122 Physics with Calculus I
- MTHSC 106 Calculus of One Variable I
- ENGL 104 Introduction to English Composition

**Second Semester**
- PHYS 101 Physics with Calculus II
- PHYS 221 Physics Lab. I
- MTHSC 108 Calculus of One Variable II
- SOCI 110 Introduction to Sociology 1

**Sophomore Year**

**First Semester**
- PHYS 221 Calculus of Several Variables
- PHYS 222 Physics with Calculus II
- MTHSC 206 Calculus of Several Variables
- THEA 116 Introduction to Theater Studies

**Second Semester**
- PHYS 224 Physics Lab. III
- PHYS 222 Physics Lab. II
- MTHSC 208 Intro. to Ordinary Diff. Equations
- BIBL 116 Introduction to Biblical Literature

**Junior Year**

**First Semester**
- PHYS 300 Introduction to Research
- PHYS 321 Methods of Theoretical Physics
- MTHSC 206 Calculus of Several Variables
- ENGL 313 Advanced Composition

**Second Semester**
- PHYS 322 Mechanics II
- PHYS 325 Experimental Physics I
- PHYS 321 Mechanics I
- THEA (ENGL) 347 Introduction to Theater

**Senior Year**

**First Semester**
- PHYS 401 Senior Thesis
- PHYS 442 Electromagnetics II
- PHYS 455 Quantum Physics I
- PHYS 405 Senior Seminar

**Second Semester**
- PHYS 441 Electromagnetics I
- PHYS 456 Quantum Physics II
- PHYS 465 Thermodynamics and Statistical Mechanics
- PHYS 442 Electromagnetics II

**Freshman Year**

**First Semester**
- ASTR 105 Physics of the Universe
- CH 101 General Chemistry
- ENGL 104 Introduction to English Composition
- MTHSC 106 Calculus of One Variable I

**Second Semester**
- CH 102 General Chemistry
- MTHSC 108 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- THEA 116 Introduction to Theater Studies

**Sophomore Year**

**First Semester**
- PHYS 121 Introduction to Calculus I
- PHYS 122 Physics with Calculus I
- MTHSC 106 Calculus of One Variable I
- THEA 116 Introduction to Theater Studies

**Second Semester**
- PHYS 101 Physics with Calculus II
- PHYS 221 Physics Lab. I
- MTHSC 108 Calculus of One Variable II
- SOCI 110 Introduction to Sociology

**Junior Year**

**First Semester**
- PHYS 300 Introduction to Research
- PHYS 321 Methods of Theoretical Physics
- MTHSC 206 Calculus of Several Variables
- ENGL 313 Advanced Composition

**Second Semester**
- PHYS 322 Mechanics II
- PHYS 325 Experimental Physics I
- PHYS 321 Mechanics I
- THEA (ENGL) 347 Introduction to Theater

**Senior Year**

**First Semester**
- PHYS 401 Senior Thesis
- PHYS 442 Electromagnetics II
- PHYS 455 Quantum Physics I
- PHYS 405 Senior Seminar

**Second Semester**
- PHYS 441 Electromagnetics I
- PHYS 456 Quantum Physics II
- PHYS 465 Thermodynamics and Statistical Mechanics
- PHYS 442 Electromagnetics II

**Freshman Year**

**First Semester**
- PHYS 121 Introduction to Calculus I
- PHYS 122 Physics with Calculus I
- MTHSC 106 Calculus of One Variable I
- THEA 116 Introduction to Theater Studies

**Second Semester**
- PHYS 101 Physics with Calculus II
- PHYS 221 Physics Lab. I
- MTHSC 108 Calculus of One Variable II
- SOCI 110 Introduction to Sociology

**Sophomore Year**

**First Semester**
- PHYS 221 Calculus of Several Variables
- PHYS 222 Physics with Calculus II
- MTHSC 206 Calculus of Several Variables
- THEA 116 Introduction to Theater Studies

**Second Semester**
- PHYS 224 Physics Lab. III
- PHYS 222 Physics Lab. II
- MTHSC 208 Intro. to Ordinary Diff. Equations
- BIBL 116 Introduction to Biblical Literature

**Junior Year**

**First Semester**
- PHYS 300 Introduction to Research
- PHYS 321 Methods of Theoretical Physics
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**Second Semester**
- PHYS 322 Mechanics II
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- THEA (ENGL) 347 Introduction to Theater

**Senior Year**

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- PHYS 401 Senior Thesis
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- PHYS 441 Electromagnetics I
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**Freshman Year**

**First Semester**
- ASTR 105 Physics of the Universe
- CH 101 General Chemistry
- ENGL 104 Introduction to English Composition
- MTHSC 106 Calculus of One Variable I

**Second Semester**
- CH 102 General Chemistry
- MTHSC 108 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- THEA 116 Introduction to Theater Studies

**Sophomore Year**

**First Semester**
- PHYS 121 Introduction to Calculus I
- PHYS 122 Physics with Calculus I
- MTHSC 106 Calculus of One Variable I
- THEA 116 Introduction to Theater Studies

**Second Semester**
- PHYS 101 Physics with Calculus II
- PHYS 221 Physics Lab. I
- MTHSC 108 Calculus of One Variable II
- SOCI 110 Introduction to Sociology

**Junior Year**

**First Semester**
- PHYS 300 Introduction to Research
- PHYS 321 Methods of Theoretical Physics
- MTHSC 206 Calculus of Several Variables
- ENGL 313 Advanced Composition

**Second Semester**
- PHYS 322 Mechanics II
- PHYS 325 Experimental Physics I
- PHYS 321 Mechanics I
- THEA (ENGL) 347 Introduction to Theater
PHYSICS

Bachelor of Arts

The Bachelor of Arts in Physics program is ideal for students interested in acquiring a broad-based liberal education that includes a strong and solid understanding of either science or a broad exposure to engineering with a strong physics foundation.

Freshman Year

First Semester
3 - ASTR 105 Physics of the Universe
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
1 - PHYS 101 Current Topics in Modern Physics

Second Semester
4 - CH 102 General Chemistry
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
1 - PHYS 124 Physics Lab. I
3 - Arts and Humanities (Non-Lit.) Requirement

Second Semester
3 - PHYS 101 Current Topics in Modern Physics
3 - PHYS 122 Physics with Calculus I
4 - MTHSC 108 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement

Sophomore Year

First Semester
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. II
4 - Foreign Language Requirement
3 - Oral Communication Requirement

Second Semester
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - PHYS 222 Physics with Calculus III
1 - PHYS 224 Physics Lab. III
4 - Foreign Language Requirement
3 - Social Science Requirement

Junior Year

First Semester
3 - PHYS 311 Intro. to Meth. of Theoretical Phys.
3 - PHYS 321 Methods of Theoretical Physics II
3 - PHYS 325 Experimental Physics I
3 - Foreign Language Requirement
3 - Minor Requirement

Second Semester
1 - PHYS 300 Introduction to Research
3 - PHYS 312 Methods of Theoretical Physics II
3 - PHYS 322 Mechanics II
1 - PHYS 356 Modern Physics Overview
3 - PHYS 441 Electromagnetics I
3 - Foreign Language Requirement
3 - Minor Requirement

Senior Year

First Semester
3 - PHYS 455 Quantum Physics I
6 - Minor Requirement
3 - Physics Writing Requirement
3 - Physics Requirement

Second Semester
3 - HIST 172 The West and the World I or
3 - HIST 173 The West and the World II
3 - Arts and Humanities (Literature) Requirement
3 - Minor Requirement
3 - Physics Requirement
3 - Elective

122 Total Semester Hours

POLYMER AND FIBER CHEMISTRY

Bachelor of Science

The School of Materials Science and Engineering offers undergraduate degrees in Ceramic and Materials Engineering and Polymer and Fiber Chemistry.

The Bachelor of Science degree in Polymer and Fiber Chemistry is based on a foundation in physical and mathematical sciences. From this base, students are taught, using classroom instruction, laboratory courses, and individual research, to apply their scientific knowledge to the solution of problems in polymeric and fiber-based materials for diverse applications ranging from biomedical and sports to construction and communication. The degree in Polymer and Fiber Chemistry also prepares students for graduate studies in a number of science and engineering disciplines.

Graduates in Polymer and Fiber Chemistry hold jobs in corporate and personnel management, manufacturing management, design, research, development, technical service, quality control, and sales. They create new products and processes and solve problems. They create styles, patterns, textures, and colors for apparel, home, industry, and special applications. Their jobs utilize computers, automation, and product quality and are concerned with plant design, environmental control, and consumer safety.

Freshman Year

First Semester
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - TEXT 175 Intro. to Textile Manufacturing
3 - History Requirement

Second Semester
4 - CH 102 General Chemistry
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. II
3 - Arts and Humanities (Literature) Requirement

Sophomore Year

First Semester
3 - CH 223 Organic Chemistry
1 - CH 227 Organic Chemistry Lab.
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. II
3 - Arts and Humanities (Literature) Requirement

Second Semester
3 - CH 224 Organic Chemistry
1 - CH 228 Organic Chemistry Lab.
3 - ECON 200 Economics Concepts
3 - EN SP 200 Intro. to Environmental Science or
3 - HIST 122 History, Tech., and Science or
3 - HIST 124 Environmental History Survey
1 - MS&E 251 Materials Science Portfolio I
4 - MTHSC 208 Intro. to Ordinary Diff. Equations

Junior Year

First Semester
3 - CH 331 Physical Chemistry
3 - PFC 415 Intro. to Polymer Science and Engr.
1 - PFC 417 Polymer and Fiber Lab.
4 - TEXT 201 Yarn Structures and Formation
3 - Technical Writing Requirement

Second Semester
3 - CH 332 Physical Chemistry
3 - COMM 250 Public Speaking
3 - MS&E 324 Statistics for MS&E
3 - PFC 416 Chemical Preparation of Textiles
4 - TEXT 202 Fabric Structure, Des., and Analysis

Senior Year

First Semester
3 - PFC 457 Dyeing and Finishing I
1 - PFC 459 Dyeing and Finishing I Lab.
3 - TEXT 421 Fiber Science
5 - Approved Requirement
3 - Departmental Requirement

Second Semester
1 - MS&E 451 MS&E Portfolio II
3 - MS&E 491 Undergraduate Research
3 - PFC 458 Dyeing and Finishing II
1 - PFC 460 Dyeing and Finishing II Lab.
3 - TEXT 422 Properties of Textile Structures
3 - Departmental Requirement

120 Total Semester Hours

1 - HIST 172 or 173
2 - See General Education Requirements.
3 - Select any 200-level ENGL course from General Education Arts and Humanities (Literature) Requirement.
4 - See advisor.
MINORS

Following are minors acceptable for students in the College of Engineering and Science. Students cannot major and minor in the same field or acquire a minor that is not allowed by the degree program.

Accounting
Adult/Extension Education
Aerospace Studies
Agricultural Business Management
Agricultural Mechanization and Business
American Sign Language Studies
Animal and Veterinary Sciences
Anthropology
Architecture
Athletic Leadership
Biochemistry
Biological Sciences
Business Administration
Chemistry
Cluster
Communication Studies
Computer Science—not open to Computer Information Systems majors
Crop and Soil Environmental Science
East Asian Studies
Economics
Education
English
Entomology
Entrepreneurship
Environmental Engineering
Environmental Science and Policy
Equine Business
Film Studies
Financial Management
Food Science
Forest Products
Forest Resource Management
Genetics
Geography
Geology
Global Politics
Great Works
History
Horticulture
International Engineering and Science
Legal Studies
Management
Management Information Systems
Mathematical Sciences
Microbiology
Military Leadership
Modern Languages
Music
Natural Resource Economics
Nonprofit Leadership
Packaging Science
Pan African Studies
Park and Protected Area Management
Philosophy
Physics
Plant Pathology
Political Science
Psychology
Public Policy
Religion
Russian Area Studies
Science and Technology in Society
Screenwriting
Sociology
Spanish-American Area Studies
Theatre
Therapeutic Recreation
Travel and Tourism
Turfgrass
Urban Forestry
Wildlife and Fisheries Biology
Women’s Studies
Writing

See pages 36–39 for details.