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 110).

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. A Certificate in International Engineering and Science, that combines language study and an international practicum, is also offered. 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 Bioengineering, Biosystems Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, Materials Science and Engineering (Inorganic), 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 new BS degree programs in Environmental Engineering and Materials Science and Engineering (Organic) 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:
- apply knowledge of math, science, and engineering
- identify, formulate, and solve engineering problems
- design and conduct experiments and analyze data
- 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
- ENGR 1020 Engineering Disciplines and Skills
- CH 1010 General Chemistry
- MTHS 1060 Calculus of One Variable I
- ENGL 1030 Accelerated Composition
- 3 - General Education Requirement
- 16

Second Semester
- ENGR 1410 Programming and Problem Solving
- MTHS 1080 Calculus of One Variable II
- PHYS 1220 Physics with Calculus I
- 4 - Departmental Science Requirement
- 3 - General Education Requirement
- 16-17

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:
- CH 1010 General Chemistry
- ENGL 1030 Accelerated Composition
- ENGR 1020 Engineering Disciplines and Skills
- ENGR 1410 Programming and Problem Solving
- MTHS 1060 Calculus of One Variable I
- MTHS 1080 Calculus of One Variable II
- PHYS 1220 Physics with Calculus I

Each engineering program will follow the curriculum in effect at the time of admission into General Engineering, unless otherwise approved by the specific engineering department.

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 curricula. 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.

Electives for Engineering Curricula
Advisors must approve any course taken for elective credit in the Engineering curricula. Courses excluded for elective credit include PHYS 2000, 2070/2090, 2080/2100.
Registration Requirements
A cumulative grade-point average of 2.0 or higher is required for registration in engineering courses numbered 3000 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.

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 average in all engineering courses taken at Clemson. All courses with “Engineering” in the course designator (e.g., ENGR 1300, ME 4530, 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: Bioelectrical Concentration or Biomaterials 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
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement
or 3 - Social Science Requirement
Second Semester
4 - CH 1020 General Chemistry
3 - ENGR 1410 Programming and Problem Solving
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement
or 3 - Social Science Requirement
1 - Biology Requirement
Sophomore Year
First Semester
3 - BIOE 2010 Intro. to Biomedical Engineering
2 - ECE 2010 Logic and Computing Devices
3 - ECE 2020 Electric Circuits I
1 - ECE 2090 Logic and Computing Devices Lab.
1 - ECE 2110 Electrical Engineering Lab. I
4 - MTHS 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
Second Semester
3 - CE 2010 Statics
1 - ECE 2120 Electrical Engineering Lab. II
3 - ECE 2620 Electric Circuits II
2 - ENGR 2080 Engineering Graphics and Machine Design
3 - MSE 2100 Introduction to Materials Science
4 - MTHS 2080 Intro. to Ordinary Diff. Equations
Junior Year
First Semester
4 - BIOL 3150 Functional Human Anatomy
4 - CH 2010 Survey of Organic Chemistry
1 - ECE 3110 Electrical Engineering Lab. III
3 - ECE 3200 Electronics I
3 - ECE 3300 Signals, Systems, and Transforms
Second Semester
3 - BCHM 3050 Essential Elements of Biochem.
3 - BIOE 3020 Biomaterials
3 - BIOE 3700 Bioinstrumentation and Bioimaging
3 - ECE 3800 Electromagnetics
3 - BIOE or ECE Technical Requirement
Senior Year
First Semester
3 - BIOE 3200 Biomechanics
3 - BIOE 4010 Bioengineering Design Theory
3 - BIOL 4610 Cell Biology
3 - Arts and Humanities Requirement or 3 - Social Science Requirement
3 - BIOE or ECE Technical Requirement
Second Semester
1 - BIOE 4000 Senior Seminar
3 - BIOE 4320 Applied Biomedical Design
3 - BIOE 4480 Tissue Engineering
3 - Arts and Humanities Requirement or 3 - Social Science Requirement
6 - BIOE or ECE Technical Requirement

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.
2Students planning to enter medical school should take CH 2230/2270 instead of CH 2010 and take CH 2240/2280 as an additional course sequence. Students planning to enter medical school should also take physics laboratories as additional courses (PHYS 1220 course with PHYS 1240 lab and PHYS 2210 course with PHYS 2230 lab).
3Select from department-approved list.

Notes:
1. To transfer from General Engineering into the Bioengineering degree program, students must have a minimum cumulative engineering grade-point average 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 ECE courses (excluding ECE 3070, 3080, 3100) 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 average of 2.0 to enroll in any 3000- or 4000-level ECE courses.
4. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any ECE course.

BIOMATERIALS
CONCENTRATION
Freshman Year
First Semester
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement or 3 - Social Science Requirement
Second Semester
4 - CH 1020 General Chemistry
3 - ENGR 1410 Programming and Problem Solving
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement or 3 - Social Science Requirement
1 - Biology Requirement
Sophomore Year
First Semester
3 - BIOE 2010 Intro. to Biomedical Engineering
4 - CH 2010 Survey of Organic Chemistry
3 - MSE 2100 Introduction to Materials Science
4 - MTHS 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II

Second Semester
3 - BIOE 3020 Biomaterials
3 - CE 2010 Statics
2 - ECE 3070 Basic Electrical Engineering
1 - ECE 3090 Electrical Engineering Lab. I
2 - ENGR 2080 Engineering Graphics and Machine Design
4 - MTHS 2080 Intro. to Ordinary Diff. Equations

Junior Year
First Semester
3 - BIOE 3200 Biomechanics
4 - BIOL 3150 Functional Human Anatomy
3 - MSE 3190 Materials Processing I
3 - MSE 3260 Thermodynamics of Materials
3 - MSE 3270 Transport Phenomena

Second Semester
3 - BCHM 3050 Essential Elements of Biochem.
3 - BIOE 3210 Biofluid Mechanics
3 - BIOE 3700 Bioinstrumentation and Bioimaging
3 - MTHS 3020 Statistics for Science and Engr.
3 - BIOE Technical Requirement

Senior Year
First Semester
3 - BIOE 4010 Bioengineering Design Theory
3 - BIOL 4640 Cell Biology
3 - MSE 4150 Intro. to Polymer Science and Engr.
3 - Arts and Humanities Requirement or Social Science Requirement
3 - BIOE Technical Requirement

Second Semester
1 - BIOE 4000 Senior Seminar
3 - BIOE 4300 Applied Biomedical Design
3 - BIOE 4480 Tissue Engineering
3 - Arts and Humanities Requirement or Social Science Requirement
6 - Bioengineering Technical Requirement

128 Total Semester Hours

Note: To transfer from General Engineering into the Bioengineering degree program, students must have a minimum cumulative grade-point average 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.

BIOSYSTEMS ENGINEERING

Bachelor of Science
Biosystems engineering is the field of engineering most closely allied with advances in biology. Biosystems engineers apply engineering design and analysis to biological systems and incorporate fundamental principles of engineering to achieve ecological balance.

The Biosystems engineering program emphasizes two main areas – sustainable bioprocess engineering, with its basis in microbiology, and ecological engineering, with its basis in ecology. Bioprocess engineering focuses on the sustainable production of bioenergy compounds - biofuels, nutraceuticals, bioactive molecules, and biomaterials - using metabolic pathways found in nature and green processing technologies. Ecological engineering focuses on the design of sustainable communities utilizing low impact development strategies such as bioretention basins, rainwater harvesting, and bioswales for stormwater retention, treatment, and management. Both emphasis areas interface with ecologically-sound food and energy-crop production systems.

Biosystems engineers lead teams to:
- Design bioprocesses and systems for biofuels (biodiesel, hydrogen, ethanol), biopharmaceutical, bioplastics, and food processing industries
- Develop ecological designs (permeable pavement, bioswales, green infrastructure) to integrate water management into the landscape
- Integrate ecological sustainability into energy, water and food systems
- Provide engineering expertise for agriculture, food processing, and manufacturing industries.

Biosystems engineering graduates are highly qualified to pursue graduate studies in biosystems engineering, biomedical engineering or ecological engineering fields, or medical or veterinary school.

Students are urged to complete a minor and participate in the Cooperative Education, Biosystems Engineering Intern, and/or Study Abroad Programs. Those interested in medical school can fulfill requirements with the Biosystems Engineering BS degree.

Additional information is available from the department offices or at: http://www.clemson.edu/majors/biosystems-engineering.

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 or Master of Science Degree in Bioengineering while completing the BS degree.

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.

Freshman Year
First Semester
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement or Social Science Requirement

Second Semester
4 - CH 2230 Organic Chemistry
3 - ENGR 1410 Programming and Problem Solving
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement or Social Science Requirement

Sophomore Year
First Semester
2 - BE 2120 Fundamentals of Biosystems Engr.
3 - CE 2010 Statics
4 - MTHS 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
4 - Biology Requirement

Second Semester
2 - BE 2100 Intro. to Biosystems Engineering
2 - CE 2080 Dynamics
2 - ENGR 2100 Computer-Aided Design and Engineering Applications
3 - ME 3100 Thermodynamics and Heat Transfer
4 - MIR 3050 General Microbiology
4 - MTHS 2080 Intro. to Ordinary Diff. Equations

Junior Year
First Semester
3 - BE 3200 Principles and Practices of Geomatics
3 - BE 4100 Biol. Kinetics and Reactor Modeling
3 - CH 2230 Organic Chemistry
1 - CH 2270 Organic Chemistry Laboratory
2 - ECE 3070 Basic Electrical Engineering
1 - ECE 3090 Electrical Engineering Lab. I
3 - Mechanics of Materials Requirement

3 - 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.

2 - Students planning to enter medical school should take CH 2230/2270 instead of CH 2210 and take CH 2240/2280 as an additional course sequence. Students planning to enter medical school should also take physics laboratories as additional courses (PHYS 1220 course with PHYS 1240 lab and PHYS 2230 course with PHYS 2230 lab).

1 - Select from department-approved list.
BIOPROCESS ENGINEERING
EMPHASIS AREA

Senior Year

First Semester
3 - BE 4280 Biochemical Engineering
2 - BE 4740 Biosystems Engr. Design/Project Mgr.
2 - BE 4750 Biosystems Engr. Capstone Design
3 - BIOL 4410 Ecology
5 - Biochemistry Requirement1

Second Semester
6 - Engineering Requirement2
3 - Life Science Requirement4
6 - Arts and Humanities Requirement1 or 2 - Social Science Requirement1

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128 Total Semester Hours

1Students should choose courses to fulfill General Education requirements including Humanities, Social Science, Cross-Cultural Awareness and Science and Technology in society components. See Undergraduate Announcements and academic advisor for details.
2ME 2010 may be substituted for CE 2010 and 2080
3BIE 1030/1050 or 1100
4CE 2060 or ME 5200

ECOLOGICAL ENGINEERING
EMPHASIS AREA

Senior Year

First Semester
2 - BE 4740 Biosystems Engr. Design/Project Mgr.
2 - BE 4750 Biosystems Engr. Capstone Design
3 - BIOL 4410 Ecology
3 - Arts and Humanities Requirement1 or 2 - Social Science Requirement1
3 - Ecological Requirement2
2 - Engineering Requirement3

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Second Semester
2 - BE 4210 Engineering Systems for Soil Water Management
3 - BE 4240 Ecological Engineering
3 - Arts and Humanities Requirement1 or 2 - Social Science Requirement1
3 - Ecological Requirement2
3 - Engineering Requirement3

15

128 Total Semester Hours

1Students should choose courses to fulfill General Education requirements including Humanities, Social Science, Cross-Cultural Awareness and Science and Technology in society components. See Undergraduate Announcements and academic advisor for details.
2ME 2010 may be substituted for CE 2010 and 2080
3BIE 1030/1050 or 1100
4CE 2060 or ME 5200

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 classrooms and laboratory instruction and emphasizes broadly applicable fundamental principles and current technology to prepare graduates for professional practice and professional growth.

The Educational Objective of the BS degree program is for graduates to have careers characterized by:

• success in chemical engineering practice, postgraduate education, or other areas making use of engineering skills, as defined by accomplishments and/or job satisfaction;
• 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 professional contributions;
• demonstrated technical and/or managerial leadership; and
• demonstrated commitment to lifelong learning.

Combined Bachelor of Science/Master of Science

Qualified students can reduce the time to earn a Master’s Degree by applying graduate credits to both the Bachelor’s and Master’s program requirements. Undergraduate Chemical and Biomolecular Engineering students who have earned a grade-point average of 3.4 or above and completed 90 credit hours can begin work toward a Master of Science in Chemical Engineering or a Master of Science in Environmental Engineering and Science by selecting approved graduate courses for their emphasis area. Details are available in the ChBE Undergraduate Handbook, which can be found at www.clemson.edu/ces/chbe.

Freshman Year

First Semester
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or 3 - Social Science Requirement1

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Second Semester
4 - CH 1020 General Chemistry
2 - CHE 1300 Chemical Engineering Tools
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement1 or 3 - Social Science Requirement1

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Sophomore Year

First Semester
3 - CH 2230 Organic Chemistry
4 - CHE 2110 Intro. to Chemical Engineering
4 - MTHS 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
3 - Arts and Humanities Requirement1 or 3 - Social Science Requirement1

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Second Semester
3 - CH 2240 Organic Chemistry
1 - CH 2290 Organic Chemistry Lab.
3 - CHE 2220 Chemical Engr. Thermodynamics I
4 - CHE 2300 Fluids/Heat Transfer
4 - MTHS 2080 Intro. to Ordinary Diff. Equations

15
Junior Year
First Semester
1. CH 3390 Physical Chemistry Lab.
2. CHE 3070 Unit Operations Lab. I
3. CHE 3190 Engineering Materials
4. ECE 3070 Basic Electrical Engineering
5. ECE 3090 Electrical Engineering Lab. I
6. EXST 4110 Statistical Methods for Process Development and Control
7. Biochemistry Option or Emphasis Area
8. Social Science Requirement
9. Humanities and Social Sciences Requirement
10. Biological Science Requirement
11. 3 Total Semester Hours

Second Semester
1. CHE 3320 Physical Chemistry
2. CH 3400 Physical Chemistry Lab.
3. CHE 3210 Chemical Engr. Thermodynamics II
4. CHE 3300 Mass Transfer and Separation Process
5. Arts and Humanities Requirement or Emphasis Area
6. Social Science Requirement
7. Biochemistry Option or Emphasis Area
8. 3 Total Semester Hours

Senior Year
First Semester
1. CHE 4070 Unit Operations Lab. II
2. CHE 4310 Chemical Process Design I
3. CHE 4430 Chemical Engr. Senior Seminar I
4. CHE 4500 Chemical Reaction Engineering
5. Arts and Humanities Requirement or Emphasis Area
6. Social Science Requirement
7. Emphasis Area Requirement
8. 3 Total Semester Hours

Second Semester
1. CHE 3530 Process Dynamics and Control
2. CHE 4330 Process Design II
3. CHE 4440 Chemical Engr. Senior Seminar II
4. MICR 4130 Industrial Microbiology
5. Arts and Humanities Requirement or Emphasis Area
6. Social Science Requirement
7. Emphasis Area Requirement
8. 3 Total Semester Hours

129 Total Semester Hours

Second Semester
1. CHE 4070 Unit Operations Lab. II
2. CHE 4310 Chemical Process Design I
3. CHE 4430 Chemical Engr. Senior Seminar I
4. CHE 4500 Chemical Reaction Engineering
5. Arts and Humanities Requirement or Emphasis Area
6. Social Science Requirement
7. 3 Total Semester Hours

Sophomore Year
First Semester
1. BIOL 1100 Principles of Biology I
2. CH 2230 Organic Chemistry
3. CHE 2110 Intro. to Chemical Engineering
4. MTHS 2060 Calculus of Several Variables
5. Arts and Humanities Requirement or Emphasis Area
6. Social Science Requirement
7. 3 Total Semester Hours

Second Semester
1. CHE 4340 Biological Chem. Lab. Techniques
2. CHE 2240 Organic Chemistry
3. CH 2290 Organic Chemistry Lab.
4. CHE 2200 Chemical Engr. Thermodynamics II
5. CHE 2300 Fluids/Heat Transfer
6. Biochemistry Option
7. 3 Total Semester Hours

Junior Year
First Semester
1. BIOC 3020 Biomaterials
2. BCHM 4310 Physical Approach to Biochem.
3. CHE 3070 Unit Operations Lab. I
4. CHE 3190 Engineering Materials
5. MTHS 2080 Intro. to Ordinary Diff. Equations
6. 3 Total Semester Hours

Second Semester
1. BMOL 4250 Biomolecular Engineering
2. CHE 3210 Chemical Engr. Thermodynamics II
3. CHE 3300 Mass Transfer and Separation Process
4. PHYS 2210 Physics with Calculus II
5. Arts and Humanities Requirement or Emphasis Area
6. Social Science Requirement
7. 3 Total Semester Hours

Senior Year
First Semester
1. CHE 4070 Unit Operations Lab. II
2. CHE 4310 Chemical Process Design I
3. CHE 4430 Chemical Engr. Senior Seminar I
4. CHE 4500 Chemical Reaction Engineering
5. EXST 4110 Statistical Methods for Process Development and Control
6. Engineering Requirement
7. 3 Total Semester Hours

Second Semester
1. CHE 3530 Process Dynamics and Control
2. CHE 4330 Process Design II
3. CHE 4440 Chemical Engr. Senior Seminar II
4. Arts and Humanities Requirement or Emphasis Area
5. Social Science Requirement
6. Engineering Requirement
7. 3 Total Semester Hours

131 Total Semester Hours

1See 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.
2See 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.
3See 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.
4See 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.
5See 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.
6See 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.
7See 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.
8See 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.
9See 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.
10See 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.
11See 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.
12See 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.
13See 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.

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 91 for the College of Engineering and Science. The complete objectives of the program can be found at www.clemson.edu/ce.

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, life-long 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.

To be eligible for admission into the Bachelor of Science degree program in Civil Engineering, students must have completed the courses outlined in the freshman core curriculum and have a cumulative grade-point average of 2.6 or higher.

The Department of Civil Engineering allows eligible students to count up to six hours of graduate credit (6000- and 8000-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
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
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Second Semester
3 - ENGR 1410 Engineering Fundamentals
2 - ENGR 2100 Computer-Aided Design and Engineering Applications
3 - GEOL 1010 Physical Geology
1 - GEOL 1030 Physical Geology Lab.
4 - MTHS 1080 Calculus of One Variable II
1 - PHYS 1220 Physics with Calculus I
1 - PHYS 1240 Physics Lab. I
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Sophomore Year
First Semester
3 - CE 2010 Statics
3 - CE 2550 Geometrics
4 - MTHS 2060 Calculus of Several Variables
4 - MTHS 2210 Physics with Calculus II
1 - PHYS 2230 Physics Lab. II
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
15

Second Semester
4 - CE 2060 Structural Mechanics
2 - CE 2080 Dynamics
2 - CE 3520 Economic Evaluation of Projects
4 - MTHS 2080 Intro. to Ordinary Diff. Equations
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Junior Year
First Semester
3 - CE 3010 Structural Analysis
3 - CE 3310 Construction Engineering and Mgt.
4 - CE 3410 Introduction to Fluid Mechanics
4 - CE 3510 Civil Engineering Materials
3 - EXST 3010 Introductory Statistics
17

Second Semester
3 - CE 3110 Transportation Engineering Planning and Design
4 - CE 3210 Geotechnical Engineering
3 - CE 3420 Applied Hydraulics and Hydrology
1 - CE 3530 Professional Seminar
3 - EES 4010 Environmental Engineering
3 - Design Technical Requirement2
17

Senior Year
First Semester
3 - ENGL 3140 Technical Writing
3 - Design Technical Requirement2
6 - Technical Requirement1
3 - Technical Requirement Restricted1
15

Second Semester
3 - CE 4590 Capstone Design Project
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Arts and Humanities (Literature) Requirement1
3 - Technical Requirement1
3 - Elective
15

129 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.

Sophomore Year
First Semester
1 - CE 2120 Electrical Engineering Lab. II
1 - ECE 2720 Computer Organization
1 - ECE 2730 Computer Organization Laboratory
4 - MTHS 2080 Intro. to Ordinary Diff. Equations
15

Second Semester
1 - ECE 2120 Electrical Engineering Lab. II
1 - ECE 2130 Digital Computer Design
2 - ECE 2220 Computer Organization
6 - Arts and Humanities Requirement1
or 6 - Social Science Requirement1

106 Total Semester Hours

Sophomore Year
First Semester
3 - ENGR 1410 Programming and Problem Solving
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
6 - Arts and Humanities Requirement1 or
6 - Social Science Requirement1

Junior Year
First Semester
3 - ECE 2230 Computer Systems Engineering
1 - ECE 3110 Electrical Engineering Lab. III
3 - ECE 3200 Electronics I
3 - ECE 3300 Signals, Systems, and Transforms
3 - ECE 3710 Microcontroller Interfacing
1 - ECE 3720 Microcontroller Interfacing Lab.
3 - MTHS 3100 Linear Algebra
17

Second Semester
3 - ECE 3170 Random Signal Analysis
3 - ECE (CPSC) 3220 Intro. to Operating Systems
3 - ECE 3310 Digital Computer Design
3 - ECE 3320 Programming Systems
3 - MTHS 4190 Discrete Math. Structures I
15

Senior Year
First Semester
3 - COMM 1500 Intro. to Human Comm. or
3 - COMM 2500 Public Speaking
3 - ECE 4950 Integrated System Design I
3 - ECE 4960 Integrated System Design II
3 - ENGL 3140 Technical Writing
6 - Computer Engineering Technical Requirement2
17

Second Semester
2 - ECE 4960 Integrated System Design II
3 - Arts and Humanities (Literature) Requirement1
3 - Computer Engineering Technical Requirement2
3 - Computer Engineering Technical Depth Req.2
3 - Special Requirement4
14

127 Total Semester Hours

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 micro, mainframe, 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/ccc/.
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/ece/.

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
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or Social Science Requirement1

Second Semester
4 - CH 1020 General Chemistry
3 - ENGR 1410 Programming and Problem Solving
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement or Social Science Requirement

Sophomore Year

First Semester
3 - CPSC 1110 Elementary Computer Programming in C/C++
2 - ECE 2010 Logic and Computing Devices
3 - ECE 2020 Electric Circuits I
1 - ECE 2090 Logic and Computing Devices Lab.
1 - ECE 2110 Electrical Engineering Lab. I
4 - MTHS 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II

Second Semester
1 - ECE 2120 Electrical Engineering Lab. II
3 - ECE 2620 Electric Circuits II
3 - ECE 2720 Computer Organization
1 - ECE 2730 Computer Organization Laboratory
4 - MTHS 2080 Intro. to Ordinary Diff. Equations
3 - Arts and Humanities Requirement or Social Science Requirement
3 - Electrical Engineering Technical Req.1,2

Junior Year

First Semester
1 - ECE 3110 Electrical Engineering Lab. III
3 - ECE 3200 Electronics I
3 - ECE 3300 Signals, Systems, and Transforms
3 - ECE 3600 Electric Power Engineering
3 - ECE 3810 Electromagnetics
3 - Advanced Mathematics Requirement

Second Semester
1 - ECE 3120 Electrical Engineering Lab. IV
3 - ECE 3710 Random Signal Analysis
3 - ECE 3210 Electronics II
3 - ECE 3710 Microcontroller Interfacing
1 - ECE 3720 Microcontroller Interfacing Lab.
3 - ECE 3810 Fields, Waves, and Circuits
3 - ENGL 3140 Technical Writing

Senior Year

First Semester
3 - COMM 1500 Intro. to Human Comm. or 3 - COMM 2500 Public Speaking
3 - ECE 4090 Continuous and Discrete Syst. Des.
3 - ECE 4270 Communications Systems
2 - ECE 4950 Integrated Systems Design I
3 - Electrical Engineering Technical Req.1

Second Semester
2 - ECE 4960 Integrated System Design II
3 - Arts and Humanities Requirement or Social Science Requirement
3 - Arts and Humanities Requirement or Social Science Requirement
3 - Electrical Engineering Technical Req.1
3 - Electrical Engineering Technical Depth Req.1
3 - Special Requirement1

126 Total Semester Hours

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, mathematicians, 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 treatment processes; reduce human health risks by tracking contaminants as they move through the environment; clean up toxic waste spills and restore historically contaminated sites; and devise a more sustainable future by understanding our use of resources.

The curriculum for the Bachelor of Science degree in Environmental Engineering consists of 128-129 credit hours. All students participate in one professional seminar course and complete a capstone design project.

Notes:
1. A student is allowed to enroll in ECE courses (excluding ECE 3070, 3080, 3090) 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 average of 2.0 to enroll in any 3000 or 4000-level ECE courses.
3. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any ECE course.
4. See General Education section of the Undergraduate Announcements. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.
5. Students may enroll in ECE 2220 for a common semester with Computer Engineering. Those not selecting this option should complete the Electrical Engineering Technical Requirement in the senior year.
6. Select from department-approved list.
7. See General Education section of the Undergraduate Announcements. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.
8. Students may enroll in ECE 2730 for a common semester with Computer Engineering. Those not selecting this option should complete the Electrical Engineering Technical Requirement in the senior year.
9. Select from department-approved list.
10. See General Education section of the Undergraduate Announcements. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.
11. Students may enroll in ECE 3070, 3080, 3090 only when all prerequisites have been passed with a grade of C or better.
12. All Engineering students must have a cumulative engineering grade-point average of 2.0 to enroll in any 3000 or 4000-level ECE courses.
13. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any ECE course.
Freshman Year
First Semester
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement
16
Second Semester
3 - EES 4860 Pollution Prevention
3 - EES 4800 Environmental Risk Assessment
3 - EES 4500 Environ. Engr. Senior Seminar
1 - EES 4030 Water and Wastewater Treat. Lab
3 - PHYS 1220 Physics with Calculus I
17
Sophomore Year
First Semester
3 - BIOL 1030 General Biology
1 - BIOL 1050 General Biology Lab
3 - CE 2010 Statics
3 - EES 2010 Environmental Engineering Fund. I
4 - MTHS 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
16
Second Semester
2 - CE 2080 Dynamics
4 - CH 2010 Survey of Organic Chemistry
2 - ENGR 2100 Computer-Aided Design and Engineering Applications
4 - EES 2020 Environmental Engineering Fund. II
4 - MTHS 2080 Intro. to Ordinary Diff. Equations
15
Junior Year
First Semester
3 - EES 4020 Water and Wastewater Treatment
1 - EES 4030 Water and Wastewater Treat. Lab
4 - MICR 3050 General Microbiology
2 - Engineering Economics Requirement
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
3 - Statistics Requirement
16
Second Semester
4 - CE 3410 Introduction to Fluid Mechanics
3 - EES 4840 Municipal Solid Waste Mgt.
3 - EES 4850 Hazardous Waste Management
3 - ME 3100 Thermodynamics and Heat Transfer
4 - Earth Science Requirement
17
Senior Year
First Semester
3 - EES 4300 Air Pollution Engineering
1 - EES 4500 Environ. Engr. Senior Seminar
3 - EES 4800 Environmental Risk Assessment
3 - EES 4860 Pollution Prevention
5 - Engineering or Science Requirement
15
Second Semester
3 - EES 4750 Capstone Design Project
5 - Engineering or Science Requirement
6 - Arts and Humanities Requirement or
6 - Social Science Requirement
14
128 Total Semester Hours

See Policy on Humanities and Social Sciences for Engineering Curricula. Three of these credit hours must also satisfy the Cross-Cultural Awareness General Education requirement. Students are encouraged (but not required) to take PHL 3450 (Environmental Ethics) to fulfill the non-literature humanities requirement.

May substitute EGR 1300 or CHE 1300. Students selecting this option must make up one hour in any manner they choose.

HIST 1240 satisfies three credit hours of the social science requirement and the Science and Technology in Society General Education requirement. If a student is unable to enroll in the second semester of the freshman year, this course may be taken at another time.

May substitute BIOL 1100 for 1030 and 1050; BIOL 1100 is five hours.

May substitute CH 2230 and 2270.

ENGR 2080 or ENGR 2090 may be substituted.

BIOL 2110 may be substituted. Students selecting this option must make up one hour in any manner they choose.

Select CE 3520 or IE 3840.

Select from EXST 3010, GEOL 2110 or MTHS 3020.

Select from GEOL 1010 and 1050, or CSE 2020.

Choose any combination of engineering and/or sciences courses from a department-approved list.

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. The Industrial Engineering baccalaureate program prepares graduates to: (1) design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy using appropriate analytical, computational and experimental practices; (2) apply information technologies to the practice of industrial engineering; (3) conduct themselves in a professional and ethical manner; and (4) work and communicate effectively with colleagues at every level in the 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 6000- and 8000-level courses) toward both the bachelor’s and master’s degrees. Students participating in this program must have a minimum grade-point average 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
First Semester
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
16
Second Semester
3 - EES 4860 Pollution Prevention
3 - EES 4800 Environmental Risk Assessment
3 - EES 4500 Environ. Engr. Senior Seminar
1 - EES 4030 Water and Wastewater Treat. Lab
3 - PHYS 1220 Physics with Calculus I
17
Sophomore Year
First Semester
3 - BIOL 1030 General Biology
1 - BIOL 1050 General Biology Lab
3 - CE 2010 Statics
3 - EES 2010 Environmental Engineering Fund. I
4 - MTHS 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
16
Second Semester
2 - CE 2080 Dynamics
4 - CH 2010 Survey of Organic Chemistry
2 - ENGR 2100 Computer-Aided Design and Engineering Applications
4 - EES 2020 Environmental Engineering Fund. II
4 - MTHS 2080 Intro. to Ordinary Diff. Equations
15
Junior Year
First Semester
3 - EES 4020 Water and Wastewater Treatment
1 - EES 4030 Water and Wastewater Treat. Lab
4 - MICR 3050 General Microbiology
2 - Engineering Economics Requirement
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
3 - Statistics Requirement
16
Second Semester
4 - CE 3410 Introduction to Fluid Mechanics
3 - EES 4840 Municipal Solid Waste Mgt.
3 - EES 4850 Hazardous Waste Management
3 - ME 3100 Thermodynamics and Heat Transfer
4 - Earth Science Requirement
17
Senior Year
First Semester
3 - EES 4300 Air Pollution Engineering
1 - EES 4500 Environ. Engr. Senior Seminar
3 - EES 4800 Environmental Risk Assessment
3 - EES 4860 Pollution Prevention
5 - Engineering or Science Requirement
15
Second Semester
3 - EES 4750 Capstone Design Project
5 - Engineering or Science Requirement
6 - Arts and Humanities Requirement or
6 - Social Science Requirement
14
128 Total Semester Hours

See Policy on Humanities and Social Sciences for Engineering Curricula. Three of these credit hours must also satisfy the Cross-Cultural Awareness General Education requirement. Students are encouraged (but not required) to take PHL 3450 (Environmental Ethics) to fulfill the non-literature humanities requirement.

May substitute ENGR 1300 or CHE 1300. Students selecting this option must make up one hour in any manner they choose.

HIST 1240 satisfies three credit hours of the social science requirement and the Science and Technology in Society General Education requirement. If a student is unable to enroll in the second semester of the freshman year, this course may be taken at another time.

May substitute BIOL 1100 for 1030 and 1050; BIOL 1100 is five hours.

May substitute CH 2230 and 2270.

ENGR 2080 or ENGR 2090 may be substituted.

BIOL 2110 may be substituted. Students selecting this option must make up one hour in any manner they choose.

Select CE 3520 or IE 3840.

Select from EXST 3010, GEOL 2110 or MTHS 3020.

Select from GEOL 1010 and 1050, or CSE 2020.

Choose any combination of engineering and/or sciences courses from a department-approved list.

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. The Industrial Engineering baccalaureate program prepares graduates to: (1) design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy using appropriate analytical, computational and experimental practices; (2) apply information technologies to the practice of industrial engineering; (3) conduct themselves in a professional and ethical manner; and (4) work and communicate effectively with colleagues at every level in the 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 6000- and 8000-level courses) toward both the bachelor’s and master’s degrees. Students participating in this program must have a minimum grade-point average 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.
Second Semester
3 - COMM 1500 Intro. to Human Comm. or
3 - COMM 2500 Public Speaking
2 - ECE 3070 Basic Electrical Engineering
1 - ECE 3090 Electrical Engineering Lab. I
3 - IE 3610 Design and Control of Industrial Sys. II
3 - IE 3810 Methods of Operational Research II
3 - IE 3860 Production Planning and Control
15

Senior Year
First Semester
3 - IE 4610 Quality Engineering
3 - IE 4650 Facilities Planning and Design
4 - IE 4820 Systems Modeling
3 - Engineering Requirement1
3 - Technical Requirement2
16
Second Semester
3 - IE 4670 Systems Design II
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Management Requirement2
3 - Technical Requirement2
12
124 Total Semester Hours

3 - MSE 2100 Introduction to Materials Science
3 - MSE 3270 Transport Phenomena
3 - MSE 4150 Intro. to Polymer Sci. and Engr.
15

Second Semester
3 - EXST 3010 Introductory Statistics or
3 - MTHS 3020 Statistics for Science and Engr.
3 - IE 3840 Engineering Economic Analysis
3 - MSE 3280 Phase Diagrams for Materials
2 - MSE 3420 Structure/Property Laboratory
3 - MSE 3610 Proc. Metals and Their Composites
3 - MSE 4220 Mechanical Behavior of Materials
17

Senior Year
First Semester
3 - MSE 4020 Solid State Materials
3 - MSE 4130 Noncrystalline Materials
3 - MSE 4320 Manufacturing Processes and Sys.
1 - MSE 4410 Manufacturing Laboratory
3 - MSE 4910 Undergraduate Research
13
Second Semester
3 - MSE 4070 Senior Capstone Design
3 - MSE 4160 Electrical Properties of Materials
3 - MSE 4240 Optical Materials and Applications
3 - MSE 4330 Combustion System and
Environmental Emissions
1 - MSE 4450 Practice of Materials Engineering
13
124 Total Semester Hours

3 - SEE Policy on Humanities and Social Sciences for Engineering
Curricula. Six of these credits must also satisfy the Cross-
Cultural Awareness and the Science and Technology in Society
General Education requirements.

POLYMERIC MATERIALS
CONCENTRATION

Freshman Year
First Semester
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16
Second Semester
4 - CH 1020 General Chemistry
3 - ENGR 1410 Programming and Problem Solving
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Sophomore Year
First Semester
4 - CH 2010 Survey of Organic Chemistry
3 - MSE 2100 Introduction to Materials Science
4 - MTHS 2060 Calculus of Several Variables
4 - PHYS 2210 Physics with Calculus II
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Second Semester
3 - CE 2010 Statics
2 - ENGR 2080 Engineering Graphics and Machine
Design
1 - MSE 2410 Metrics Laboratory
4 - MTHS 2080 Intro. to Ordinary Diff. Equations
6 - Arts and Humanities Requirement1 or
6 - Social Science Requirement1
16

Junior Year
First Semester
3 - COMM 2500 Public Speaking
3 - MSE 3190 Materials Processing I
3 - MSE 3260 Thermodynamics of Materials
3 - MSE 3270 Transport Phenomena
3 - MSE 4550 Intro. to Polymer Sci. and Engr.
15
Second Semester
3 - EXST 3010 Introductory Statistics or
3 - MTHS 3020 Statistics for Science and Engr.
3 - IE 3840 Engineering Economic Analysis
3 - MSE 3280 Phase Diagrams for Materials
2 - MSE 3420 Structure/Property Laboratory
3 - MSE 3610 Proc. Metals and Their Composites
3 - MSE 4220 Mechanical Behavior of Materials
17

Senior Year
First Semester
3 - MSE 4020 Solid State Materials
3 - MSE 4130 Noncrystalline Materials
3 - MSE 4320 Manufacturing Processes and Sys.
1 - MSE 4410 Manufacturing Laboratory
3 - MSE 4910 Undergraduate Research
13
Second Semester
3 - MSE 4070 Senior Capstone Design
3 - MSE 4160 Electrical Properties of Materials
3 - MSE 4240 Optical Materials and Applications
3 - MSE 4330 Combustion System and
Environmental Emissions
1 - MSE 4450 Practice of Materials Engineering
13
124 Total Semester Hours

3 - SEE Policy on Humanities and Social Sciences for Engineering
Curricula. Six of these credits must also satisfy the Cross-
Cultural Awareness and the Science and Technology in Society
General Education requirements.

MATERIALS SCIENCE AND
ENGINEERING

Bachelor of Science
Materials scientists and engineers design, develop, and produce traditional and new advanced materials with diverse applications intended for use in a wide variety of industries. These include traditional materials-intensive industries such as structural clay, foundry, white iron, polymers, plastics, fibers, textiles, composite materials, and automotive industries. Also included are high performance technology industries such as semiconductor, defense, biomatери-
als, aerospace, and communication industries. The broad career responsibilities of these 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 School of Materials Science and Engineering offers two areas of concentration within the Bachelor of Science degree in Materials Science and Engineering. The Inorganic Materials Concentration provides for more in-depth study of the engineering and science of materials such as ceramics, glasses, metals, optical and electronic materials; while the Polymeric Materials Concentration provides more emphasis on plastics, elastomers, fibers and fibrous materials, films, coatings and adhesives. Students select either the Inorganic Materials Concentration or the Polymeric Materials Concentration at the beginning of their sophomore year. Both concentra-

...tions in Materials Science and Engineering integrate laboratory with classroom experiences to prepare students for life-long learning and exciting career opportunities. Courses covering thermodynamics, kinetics, mechanical behavior, processing, fabrication and characterization of materials prepare students for careers in industry and for graduate school.

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

- demonstrate learning consistent with Accreditation Board for Engineering and Technology Engineering Criteria 2011 for materials engineering programs;
- function easily and well in the laboratory and plant environments; and
- serve the local, national, and international materials communities.

Specifically, the Accreditation Board for Engineering and Technology Engineering Criteria 2011 requires that baccalaureate degree graduates in Materials Science and 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 materials engineering selection and design problems; and
- apply appropriate experimental, statistical, and computational methods to advantage in the solution of materials problems.

INORGANIC MATERIALS
CONCENTRATION

Freshman Year
First Semester
2 - ENGR 1020 Engineering Disciplines and Skills
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
16
Second Semester
4 - CH 1020 General Chemistry
3 - ENGR 1410 Programming and Problem Solving
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
17

Sophomore Year
First Semester
4 - CH 2010 Survey of Organic Chemistry
3 - MSE 2100 Introduction to Materials Science
4 - MTHS 2060 Calculus of Several Variables
4 - PHYS 2210 Physics with Calculus II
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
17

Second Semester
3 - CE 2010 Statics
2 - ENGR 2080 Engineering Graphics and Machine
Design
1 - MSE 2410 Metrics Laboratory
4 - MTHS 2080 Intro. to Ordinary Diff. Equations
6 - Arts and Humanities Requirement or
6 - Social Science Requirement
16
Second Semester
4 - CH 1020 General Chemistry  
3 - ENGR 1410 Programming and Problem Solving  
4 - MTHS 1080 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 - CH 2230 Organic Chemistry  
1 - CH 2270 Organic Chemistry Laboratory  
3 - MTHS 2130 Introduction to Materials Science  
4 - MTHS 2060 Calculus of Several Variables  
3 - PHYS 2210 Physics with Calculus II  
3 - Arts and Humanities Requirement or 3 - Social Science Requirement  
17

Second Semester  
3 - CH 2100 Stats  
3 - CH 2240 Organic Chemistry  
1 - CH 2280 Organic Chemistry Laboratory  
2 - ENGR 2080 Engineering Graphics and Machine Design  
3 - MTHS 2500 Polymer & Fiber Science I  
4 - MTHS 2080 Intro. to Ordinary Diff. Equations  
16

Junior Year
First Semester  
3 - CH 3310 Physical Chemistry  
3 - COMM 2500 Public Speaking  
3 - MTHS 3270 Transport Phenomena  
3 - MTHS 4150 Intro. to Polymer Sci. and Engineering  
1 - MTHS 4550 Polymer and Fiber Lab.  
3 - Arts and Humanities Requirement or 3 - Social Science Requirement  
16

Second Semester  
3 - CH 3320 Physical Chemistry  
3 - EXST 3010 Introductory Statistics or 3 - MTHS 3020 Stat. for Science and Engr.  
1 - IE 3840 Engineering Economic Analysis  
3 - MTHS 4220 Mechanical Behavior or Materials  
3 - MTHS 4560 Polymer and Fiber Science II  
15

Senior Year
First Semester  
3 - MTHS 4800 Surface Phenomena in Materials Science and Engineering  
1 - MTHS 4600 Surface Phenomena in Materials Science and Engineering Laboratory  
3 - MTHS 4610 Polymer and Fiber Science III  
3 - MTHS 4910 Undergraduate Research  
3 - Technical Requirement  
13

Second Semester  
3 - MTHS 4070 Senior Capstone Design  
1 - MTHS 4450 Practice of Materials Engineering  
3 - MTHS 4570 Color Science  
1 - MTHS 4590 Color Science Laboratory  
3 - Arts and Humanities Requirement or 3 - Social Science Requirement  
14

124 Total Semester Hours  

MECHANICAL ENGINEERING

Bachelor of Science

Breadth, individuality, and flexibility are inherent characteristics of the mechanical engineering profession. Mechanical engineers, in a broad sense, make major contributions to the creation of products and systems that benefit mankind. They work in a variety of areas, including bioengineering, energy systems, environmental and life-support systems, propulsion and transportation systems, food production, materials processing, automated manufacturing, and construction. A wide spectrum of career opportunities is open to them. The practice of mechanical engineering includes one or more of the following activities: manufacturing, testing, research, development, design, technical management, technical sales and marketing, construction, and teaching.

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.

Most graduates take positions in industry, government, or business. Many, however, continue their formal education in a graduate program. The Department of Mechanical Engineering offers study leading to the Master of Science and Doctor of Philosophy degrees.

Mechanical Engineering students who have a cumulative grade-point average or cumulative engineering grade-point average (EGPA) below 2.0 are on probation and will have restricted enrollment in classes. Students whose cumulative grade-point average 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 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.

Freshman Year
First Semester  
2 - ENGR 1020 Engineering Disciplines and Skills  
4 - CH 1010 General Chemistry  
3 - ENGL 1030 Accelerated Composition  
4 - MTHS 1080 Calculus of One Variable I  
3 - Arts and Humanities (Non-Lit.) Requirement or 3 - Social Science Requirement  
16

Second Semester  
2 - ENGR 2080 Engineering Graphics and Machine Design  
3 - ENGR 1410 Programming and Problem Solving  
4 - MTHS 1080 Calculus of One Variable II  
3 - PHYS 1220 Physics with Calculus I  
1 - PHYS 1240 Physics Lab. I  
3 - Arts and Humanities (Lit.) Requirement or 3 - Social Science Requirement  
16

Sophomore Year
First Semester  
1 - ECE 3090 Electrical Engineering Lab. I  
5 - ME 2010 Statics and Dynamics for Mech. Engr.  
2 - ME 2220 Mechanical Engineering Lab. I or 3 - MTHS 2100 Intro. to Materials Science  
4 - MTHS 2060 Calculus of Several Variables  
3 - PHYS 2210 Physics with Calculus II  
15-16

Second Semester  
2 - ECE 3070 Basic Electrical Engineering  
1 - ECE 3090 Electrical Engineering Lab. I  
3 - ME 2020 Foundations of Mechanical Systems  
3 - ME 2030 Found. of Thermal and Fluid Systems  
2 - ME 2220 Mechanical Engineering Lab. I or 3 - MTHS 2100 Intro. to Materials Science  
4 - MTHS 2080 Intro. to Ordinary Diff. Equations  
15-16

Junior Year
First Semester  
3 - ENGL 3140 Technical Writing  
3 - ME 3020 Mechanics of Materials  
3 - ME 3030 Thermodynamics  
3 - ME 3080 Fluid Mechanics  
2 - ME 3330 Mechanical Engineering Lab. II or 3 - Statistics Requirement  
3 - MTHS 3650 Numerical Methods for Engineers  
17-18

Second Semester  
3 - ME 3040 Heat Transfer  
3 - ME 3050 Model. and Analysis of Dynamic Syst.  
3 - ME 3060 Fundamentals of Machine Design  
3 - ME 3120 Manufacturing Processes and Their Application  
2 - ME 3330 Mechanical Engineering Lab. II or 3 - Statistics Requirement  
14-15
Senior Year

First Semester
3 - ME 4010 Mechanical Engineering Design
3 - ME 4030 Control and Integration of Multi-Domain Dynamic Systems
1 - ME 4000 Senior Seminar
1 - ME 4440 Mechanical Engineering Lab. III or
3 - Technical Requirement
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
14-15

Second Semester
1 - ME 4020 Internship in Engineering Design
1 - ME 4040 Senior Seminar
1 - ME 4040 Internship in Mechanical Engineering
2 - ME 4440 Mechanical Engineering Lab. III or
3 - Technical Requirement
6 - Arts and Humanities Requirement or
6 - Social Science Requirement
15-16

125 Total Semester Hours

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 110. 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 1010 General Chemistry
1 - CH 1410 Chemistry Orientation
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
15

Second Semester
4 - CH 1020 General Chemistry
2 - CH 1520 Chemistry Communication I
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
16

Sophomore Year

First Semester
3 - CH 2230 Organic Chemistry
1 - CH 2270 Organic Chemistry Lab.
4 - MTHS 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
1 - PHYS 2230 Physics Lab. II
4 - Foreign Language Requirement
16

Second Semester
3 - CH 2050 Introduction to Inorganic Chemistry
3 - CH 2240 Organic Chemistry
1 - CH 2280 Organic Chemistry Lab.
4 - MTHS 2080 Intro. to Ordinary Diff. Equations
3 - PHYS 2220 Physics with Calculus III
1 - PHYS 2240 Physics Lab. III
15

Junior Year

First Semester
3 - CH 3130 Quantitative Analysis
2 - CH 3150 Quantitative Analysis Lab.
3 - CH 3310 Physical Chemistry
1 - CH 3390 Physical Chemistry Lab.
3 - ENGL 3140 Technical Writing
3 - Elective
15

Second Semester
3 - CH 3320 Physical Chemistry
1 - CH 3400 Physical Chemistry Lab.
3 - CH 3600 Chemical Biology
3 - CH 4110 Instrumental Analysis
2 - CH 4120 Instrumental Analysis Lab.
3 - Arts and Humanities (Learning) Requirement
15

Senior Year

First Semester
3 - CH 4020 Inorganic Chemistry
3 - CH 4430 Research Problems
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
3 - Chemistry Requirement
3 - Elective
15

Second Semester
2 - CH 4030 Advanced Synthetic Techniques
3 - CH 4440 Research Problems
3 - CH 4500 Chemistry Capstone
1 - CH 4520 Chemistry Communication II
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
3 - Chemistry Requirement
15

122 Total Semester Hours

Notes:
1. Enrollment Policy (see Web Site for Complete Statement of Department Policy). A student is allowed to enroll in any ME course only when all prerequisites, as defined by current official listings for that course, have been passed with a grade of C or higher.
2. No student may exceed three attempts to complete successfully ME 2210, 2030, 2030. Registration for a third attempt to complete one of these ME courses requires the approval of the undergraduate coordinator in the Department of Mechanical Engineering. A grade of W counts as an unsuccessful attempt at completing the course.
3. For students repeating an ME course, registration preference will be given to students in a degree granting engineering major whose curriculum requires the course in question.
4. To change majors into the Mechanical Engineering degree program, students must have a minimum cumulative grade point average of 2.60 or higher at Clemson and earned a grade of C or better in each course in the General Engineering freshman curriculum. EXCLUDING the Arts and Humanities/Social Science requirements.

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, and Physics. 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.
Senior Year
First Semester
3 - Arts and Humanities Requirement1 or 3 - Social Science Requirement1
3 - Chemistry Requirement1
3 - Minor Requirement
6 - Elective
15
Second Semester
3 - CH 4500 Chemistry Capstone
1 - CH 4520 Chemistry Communication II
3 - Chemistry Requirement1
6 - Minor Requirement
13
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 1020) in any modern foreign language is required.
3See advisor.
*CHM 3050 can substitute for CH 3600.

CHEMISTRY
Bachelor of Arts
Freshman Year
First Semester
4 - CH 1010 General Chemistry
1 - CH 1410 Chemistry Orientation
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or 3 - Social Science Requirement1
3 - Electrical Requirement
15
Second Semester
4 - CH 1520 Chemistry Communication I
4 - MTHS 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement2 or 3 - Social Science Requirement1

Sophomore Year
First Semester
3 - CH 1180 Organic Chemistry Lab.
1 - CH 2280 Organic Chemistry Lab.
4 - MTHS 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
3 - Foreign Language Requirement1
15
Second Semester
3 - CH 2250 Introduction to Inorganic Chemistry
3 - CH 2240 Organic Chemistry
1 - CH 2280 Organic Chemistry Lab.
6 - Arts and Humanities Requirement1 or 6 - Social Science Requirement1
4 - Foreign Language Requirement2
17
Junior Year
First Semester
3 - CH 3130 Quantitative Analysis
1 - CH 3170 Quantitative Analysis Lab.
3 - CH 3310 Physical Chemistry
3 - Arts and Humanities Requirement1 or 3 - Social Science Requirement1
3 - Foreign Language Requirement2
3 - Minor Requirement
16
Second Semester
3 - CH 3320 Physical Chemistry
3 - ENGL 3140 Technical Writing
3 - Arts and Humanities (Literature) Requirement1
3 - Foreign Language Requirement2
3 - Minor Requirement
15

Sophomore Year
First Semester
3 - CPSC 2070 Discrete Structures for Computing
4 - CPSC 2120 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement1
3 - Oral Communication Requirement1
3 - Social Science Requirement1
16
Second Semester
3 - CPSC 2150 Software Development Foundations
4 - CPSC 2310 Intro. to Computer Organization
1 - CPSC 2910 Seminar in Professional Issues I
3 - MGT 2010 Principles of Management
3 - Probability and Statistics Requirement1

Junior Year
First Semester
3 - ACCT 2010 Financial Accounting Concepts
3 - CPSC 2200 Microcomputer Applications
3 - CPSC 3220 Introduction to Operating Systems
3 - CPSC 3720 Intro. to Software Engineering
3 - Writing Requirement1
15
Second Semester
3 - ACCT 2020 Managerial Accounting Concepts
3 - CPSC 3600 Networks and Network Program.
3 - CPSC 3710 Systems Analysis or 3 - MGT 4520 Systems Analysis and Design
3 - ECON 2110 Principles of Microeconomics
3 - Computer Science Requirement1
15

Senior Year
First Semester
3 - CPSC 4200 Computer Security Principles or 3 - CPSC 4240 System Admin. and Security
3 - CPSC 4620 Database Management Systems
3 - CPSC 4910 Seminar in Professional Issues II
3 - Business Requirement1
3 - Computer Science Requirement6
15
Second Semester
3 - MGT 3120 Decision Models for Management
3 - MKT 3010 Principles of Marketing
3 - Business Requirement1
3 - Computer Science Requirement6
3 - Information Systems Requirement6
15
122 Total Semester Hours

COMPUTER INFORMATION SYSTEMS
Bachelor of Science
The Computer Information Systems degree program is oriented toward computer applications in management-related problems. The program emphasizes functional areas of management, including accounting, production, marketing, and finance and the applications of computers in these areas. The curriculum is designed to prepare students for careers in areas such as systems design and analysis, applications programming, database administration, and information retrieval, as well as for continued study toward an advanced degree.

Students who change majors into Computer Information Systems must have a cumulative grade-point average of 2.0 or higher.

Additional information can be found at www.cs.clemson.edu.

Freshman Year
First Semester
4 - CPSC 1010 Computer Science I
3 - ENGL 1030 Accelerated Composition
1 - MTHS 1020 Intro. to Mathemat. Analysis1 and 1 - Elective1 or 4 - MTHS 1060 Calculus of One Variable I1
4 - Natural Science Requirement2
15
Second Semester
4 - CPSC 1020 Computer Science II
3 - MTHS 2070 Multivariable Calculus1 and 1 - Elective1 or 4 - MTHS 1080 Calculus of One Variable II1
3 - Arts and Humanities (Non-Lit.) Requirement2
3 - Natural Science Requirement2
3 - Social Science Requirement1
17
1See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.
2Four semesters (through 2020) of the same modern foreign language are required.
3See advisor.
4MTHS 3010, 3020, or 3090.
5Select from School-approved list.
6Select from 3000-level or higher CPSC courses. No more than six credits of CPSC 4810 may be used.
7Select from MGT 3900, 4000 and FIN 3060.
8Select from School-approved list.
9Select from CPSC 4520, 4540, 4550, 4560, or 4000-level CPSC courses. CPSC 4810 may not be used.
Notes:
1. For graduation, a candidate for the BS degree in Computer Information Systems must have earned a grade of C or better in each CPSC course applied to the degree.
2. A grade of C or better must be earned in all prerequisite courses (including CPSC and MTHS courses) before enrolling in the next CPSC course.

COMPUTER SCIENCE

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) 347-7200. Additional information can be found at www.cs.clemson.edu.

Students who change majors into Computer Science must have a cumulative grade-point average 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 700-level courses) 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) 347-7200. Additional information can be found at www.cs.clemson.edu.

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

Freshman Year

First Semester
4 - CPSC 1010 Computer Science I
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
4 - Natural Science Requirement1
15

Second Semester
4 - CPSC 1020 Computer Science II
1 - Elective1
4 - CPSC 2150 Software Development Foundations
4 - CPSC 2120 Algorithms and Data Structures
3 - Arts and Humanities (Non-Lit.) Requirement2
3 - Natural Science Requirement1
15

Sophomore Year

First Semester
3 - CPSC 2120 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement2
3 - Natural Science Requirement1
3 - Oral Communication Requirement2
16

Second Semester
3 - CPSC 2150 Software Development Foundations
4 - CPSC 2310 Intro. to Computer Organization
1 - CPSC 2910 Seminar in Professional Issues I
3 - Natural Science Requirement1
3 - Probability and Statistics Requirement1
2 - Elective
16

Junior Year

First Semester
3 - CPSC 2310 Intro. to Computer Organization
1 - CPSC 2910 Seminar in Professional Issues I
3 - Natural Science Requirement1
5 - MTHS 1060 Calculus of One Variable I
4 - Elective
15

Second Semester
3 - CPSC 3220 Introduction to Operating Systems
3 - CPSC 3520 Foundations of Computer Science
3 - CPSC 3620 Distributed and Cluster Computing
3 - Arts and Humanities Requirement4 or Social Science Requirement4
3 - Social Science Requirement4
15

Senior Year

First Semester
3 - CPSC 3520 Programming Languages
6 - Computer Science Requirement5
3 - Writing Requirement6
3 - Elective
15

Second Semester
3 - CPSC 4910 Seminar in Professional Issues II
3 - Arts and Humanities Requirement4 or Social Science Requirement4
6 - Computer Science Requirement5
3 - Elective
15

122 Total Semester Hours

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 average of 2.0 or higher.

Freshman Year

First Semester
4 - CPSC 1010 Computer Science I
3 - ENGL 1030 Accelerated Composition
3 - MTHS 1020 Intro. to Mathematics Analysis1 and 1 - Elective1 or
4 - MTHS 1060 Calculus of One Variable I1
4 - Foreign Language Requirement7
15

Second Semester
4 - CPSC 1020 Computer Science II
3 - MTHS 2070 Multivariable Calculus1 and 1 - Elective1 or
4 - MTHS 1080 Calculus of One Variable II1
3 - Arts and Humanities (Non-Lit.) Req.3
4 - Foreign Language Requirement7
15

Sophomore Year

First Semester
3 - CPSC 2070 Discrete Structures for Computing
4 - CPSC 2120 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement1
3 - Foreign Language Requirement7
3 - Oral Communication Requirement1
16

Second Semester
3 - CPSC 2510 Software Development Foundations
4 - CPSC 2310 Intro. to Computer Organization
1 - CPSC 2910 Seminar in Professional Issues I
3 - Foreign Language Requirement7
3 - Natural Science Requirement1
15

Junior Year

First Semester
6 - Computer Science Requirement5
3 - Mathematical Sciences Requirement6
3 - Minor Requirement
3 - Natural Science Requirement1
15

Second Semester
3 - Computer Science Requirement5
6 - Minor Requirement
3 - Social Science Requirement3
3 - Writing Requirement1
15
and environmental science: appreciation for spatial curriculum is built around three themes in geology geological and environmental systems. The Geology from coal, petroleum, and radioactive minerals. Might be predicted, and sustainable approaches to at a fundamental level so that the history of the earth on and in the earth must be thoroughly understood physical, and biological responses to environments systems and processes involved. The chemical, in influence of life on earth and the environmental sciences. It prepares students for careers 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 environment 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.

**Senior Year**

**First Semester**

- 6 - Computer Science Requirement
- 3 - Departmental Humanities Requirement
- 3 - Minor Requirement
- 3 - Social Science Requirement

**Second Semester**

- 3 - CPSC 4910 Seminar in Professional Issues II
- 3 - Computer Science Requirement
- 3 - Fine Arts Requirement
- 3 - Minor Requirement
- 3 - Elective

121 Total Semester Hours

3Select either the MTHS 1020/1070, 106/1070, or 1060/1080 sequences. Students who select the 1060 and 1080 sequence will have satisfied the elective credits in the freshman year. Students interested in computer graphics should select the 1060/1080 sequence.

4Four semesters (through 2020) in the same modern foreign language are required.

See General Education Requirements.

Select from courses in BIOL, BCHM, CH, GEOL, MICRO, PHYS; or ENSP 2000. At least one course must include a laboratory and satisfy the Natural Science General Education Requirement.

Select from CPSC courses numbered 3000-level or higher. No more than six credits of CPSC 4810 may be applied to this requirement. Up to three credits of approved 3000-level or higher MTHS or ECE courses may be substituted.

MTHS 3010, 3020, 3090 or 3110. MTHS 3110 is required for all graphics courses.

Select from School-approved list.

Select from courses in AAH, ANTH, ART, CHIN, DANC, ENGL, FR, GER, HUM, ITAL, JAPN, MUSC, PA, PHIL, REL, RUSS, SPAN, THEA.

MUSC 2100 or any course in AAH, ART, or THEA.

**GEOLGY**

**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 environment 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 1010 General Chemistry
- 3 - ENGL 1030 Accelerated Composition
- 3 - GEOL 1010 Physical Geology
- 1 - GEOL 1030 Physical Geology Lab.
- 4 - MTHS 1060 Calculus of One Variable I

**Second Semester**

- 4 - CH 1020 General Chemistry
- 4 - GEOL 1020 Earth History
- 4 - MTHS 1080 Calculus of One Variable II
- 3 - Arts and Humanities (Non-Lit.) Requirement

**Sophomore Year**

**First Semester**

- 3 - BIOL 1030 General Biology I
- 1 - BIOL 1080 General Biology Lab. I
- 3 - GEOL 2050 Mineralogy and Intro. Petrology
- 2 - GEOL 2080 Min. and Intro. Petrography Lab.
- 4 - GEOL 2110 Geoanalysis II
- 1 - GEOL 2910 Introduction to Research I
- 1 - Elective

**Second Semester**

- 4 - CSEN 2020 Soils
- 4 - GEOL 2120 Geoanalysis II
- 1 - GEOL 2920 Introduction to Research II
- 3 - PHYS 1220 Physics with Calculus I
- 3 - Social Science Requirement

**Junior Year**

**First Semester**

- 3 - ENSP 2000 Intro. to Environmental Science
- 4 - GEOL 3020 Structural Geology
- 3 - GEOL 3160 Igneous and Metamorphic Petro. 2 - GEOL 3910 Research Methods I
- 3 - Social Science Requirement
- 2 - Elective

**Second Semester**

- 3 - GEOL 3000 Environmental Geology
- 4 - GEOL 3130 Sedimentology and Stratigraphy
- 2 - GEOL 3920 Research Methods II
- 3 - Geology Requirement
- 2 - Social Science Requirement
- 2 - Elective

**Summer**

6 - Summer Geology Field Course

**Senior Year**

**First Semester**

- 4 - GEOL 4050 Surficial Geology
- 3 - GEOL 4080 Geohydrology
- 3 - GEOL 4910 Research Synthesis I
- 2 - Elective

**Second Semester**

- 4 - GEOL 4090 Subsurface Methods
- 3 - GEOL 4920 Research Synthesis II
- 3 - Geology Requirement
- 2 - Elective

122 Total Semester Hours

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

MTHS 2060 and 2080 or 3010 or EXST 3010 may be substituted.

Select from department-approved list.

See advisor.

**ENVIRONMENTAL SCIENCE CONCENTRATION**

**Freshman Year**

**First Semester**

- 4 - CH 1010 General Chemistry
- 3 - ENGL 1030 Accelerated Composition
- 3 - GEOL 1010 Physical Geology
- 1 - GEOL 1030 Physical Geology Lab.
- 4 - MTHS 1060 Calculus of One Variable I

**Second Semester**

- 4 - CSEN 2020 Soils
- 4 - GEOL 2120 Geoanalysis II
- 1 - GEOL 2920 Introduction to Research II
- 3 - PHYS 1220 Physics with Calculus I
- 3 - Social Science Requirement
Bachelor of Arts

GEOLOGY

SECOND SEMESTER
4 - CH 1020 General Chemistry
4 - GEOL 1020 Earth History
4 - MTHS 1080 Calculus of One Variable I
3 - Arts and Humanities (Non-Lit.) Requirement
15

Sophomore Year
First Semester
3 - BIOL 1030 General Biology I
1 - BIOL 1050 General Biology Lab. I
3 - GEOL 2050 Mineralogy and Intro. Petrology
1 - GEOL 2070 Mineral. and Intro. Petrology Lab.
4 - GEOL 2110 Geoanalysis I
1 - GEOL 2910 Introduction to Research I
3 - Arts and Humanities (Literature) Requirement
16

Second Semester
3 - BIOL 1040 General Biology II
1 - BIOL 1060 General Biology Lab. II
4 - GEOL 2120 Geoanalysis II
1 - GEOL 2920 Introduction to Research II
3 - GEOG 3000 Environmental Geology
3 - PHYS 1220 Physics with Calculus I
15

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

Second Semester
3 - GEOL 3180 Introduction to Geochemistry
2 - GEOL 3920 Research Methods II
9 - Environmental Science Requirement
3 - Social Science Requirement
17

Summer
3 - Field Experience

Senior Year
First Semester
3 - ENSP 4000 Studies in Environmental Science
3 - GEOL 4080 Geochemistry
3 - GEOL 4910 Research Synthesis I
3 - Environmental Science Requirement
12

Second Semester
3 - CH 2230 Organic Chemistry or
3 - CH 4130 Chemistry of Aqueous Systems
3 - GEOL 4920 Research Synthesis II
6 - Environmental Science Requirement
12

122 Total Semester Hours

1See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Require-
ment.
2MTHS 2060 and 2080 or 3010 or EXST 3010 may be substituted.
3Select from department-approved list. At least three credit hours must be from geology courses.
4Field course in geology, ecology, or related area. Must be at least three credits. Students desiring to become registered
professional geologists should take a six-credit summer geology field course.

HYDROGEOLOGY

CONCENTRATION

Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
3 - GEOL 1010 Physical Geology
1 - GEOL 1030 Physical Geology Lab.
3 - MTHS 1060 Calculus of One Variable I
15

Second Semester
4 - CH 1020 General Chemistry
4 - GEOL 1020 Earth History
4 - MTHS 1080 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement
15

Sophomore Year
First Semester
3 - GEOL 2050 Mineralogy and Intro. Petrology
1 - GEOL 2070 Mineral. and Intro. Petrology Lab.
4 - GEOL 2110 Geoanalysis I
1 - GEOL 2910 Introduction to Research I
3 - Arts and Humanities (Literature) Requirement
3 - Technical Requirement
15

Second Semester
4 - GEOL 2120 Geoanalysis II
1 - GEOL 2920 Introduction to Research II
3 - GEOG 3000 Environmental Geology
3 - PHYS 1220 Physics with Calculus I
1 - PHYS 1240 Physics Lab. I
3 - Social Science Requirement
15

Junior Year
First Semester
4 - GEOL 3180 Sedimentology and Stratigraphy
3 - GEOL 3190 Research Methods I
3 - GEOL 4080 Geohydrology
3 - PHYS 2210 Physics with Calculus II
4 - Geology Requirement
15

Second Semester
4 - GEOL 3130 Geochemistry and Geochemistry
3 - GEOL 3180 Introduction to Geochemistry
2 - GEOL 3920 Research Methods II
9 - Environmental Science Requirement
3 - Social Science Requirement
3 - Technical Requirement
15

Summer
6 - GEOL 4750 Summer Geology Field Camp

Senior Year
First Semester
3 - GEOL 4210 GIS Applications in Geology
3 - GEOL 4910 Research Synthesis I
3 - Geology Requirement
3 - Technical Requirement
15

Second Semester
3 - EES 4010 Environmental Engineering
4 - GEOL 4090 Subsurface Methods
3 - GEOL 4920 Research Synthesis II
3 - Technical Requirement
13

121 Total Semester Hours

1See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Require-
ment.
2MTHS 2060 and 2080 or 3010 or EXST 3010 may be substituted.
3Select from department-approved list. At least three credit hours must be from geology courses.
4Field course in geology, ecology, or related area. Must be at least three credits. Students desiring to become registered
professional geologists should take a six-credit summer geology field course.

GEOLOGY

Bachelor of Arts

Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
3 - GEOL 1010 Physical Geology
1 - GEOL 1030 Physical Geology Lab.
3 - Mathematics Requirement
14

Second Semester
4 - CH 1020 General Chemistry
3 - GEOG 1030 World Regional Geography
4 - GEOL 1020 Earth History
3 - Mathematics Requirement
2 - Elective
16

Sophomore Year
First Semester
3 - BIOL 1030 General Biology I
1 - BIOL 1050 General Biology Lab. I
3 - GEOL 2050 Mineralogy and Intro. Petrology
1 - GEOL 2070 Mineral. and Intro. Petrology Lab.
4 - GEOL 2110 Geoanalysis I
1 - GEOL 2910 Introduction to Research I
3 - Arts and Humanities (Non-Lit.) Requirement
3 - Technical Requirement
15

Second Semester
3 - GEOL 2120 Geoanalysis II
1 - GEOL 2920 Introduction to Research II
3 - GEOG 3000 Environmental Geology
3 - PHYS 1220 Physics with Calculus I
1 - PHYS 1240 Physics Lab. I
3 - Social Science Requirement
15

Sophomore Year
First Semester
3 - GEOL 3180 Sedimentology and Stratigraphy
3 - GEOL 3910 Research Methods I
3 - GEOL 4080 Geohydrology
3 - PHYS 2210 Physics with Calculus II
4 - Geology Requirement
15

Second Semester
3 - GEOL 3130 Geochemistry and Geochemistry
3 - GEOL 3180 Introduction to Geochemistry
2 - GEOL 3920 Research Methods II
9 - Environmental Science Requirement
3 - Social Science Requirement
3 - Technical Requirement
15

Summer
6 - GEOL 4750 Summer Geology Field Camp

Senior Year
First Semester
3 - GEOL 4210 GIS Applications in Geology
3 - GEOL 4910 Research Synthesis I
3 - Geology Requirement
3 - Technical Requirement
15

Second Semester
3 - EES 4010 Environmental Engineering
4 - GEOL 4090 Subsurface Methods
3 - GEOL 4920 Research Synthesis II
3 - Technical Requirement
13

121 Total Semester Hours

1See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Require-
ment.
2MTHS 2060 and 2080 or 3010 or EXST 3010 may be substituted.
3Select from department-approved list. At least three credit hours must be from geology courses.
4Field course in geology, ecology, or related area. Must be at least three credits. Students desiring to become registered
professional geologists should take a six-credit summer geology field course.

College of Engineering and Science
Second Semester
2. GEOL 3920 Research Methods II
3. Foreign Language Requirement7
3. Geology Requirement6
3. Minor Requirement6
6. Elective
12

Senior Year
First Semester
3. GEOL 4910 Research Synthesis I
3. Arts and Humanities (Literature) Requirement1
3. Minor Requirement6
3. Elective
15
Second Semester
3. GEOL 4920 Research Synthesis II
3. Minor Requirement6
3. Technical Requirement6
6. Elective
15

122 Total Semester Hours

*MTHS 1060 and 1080 are recommended; however, MTHS 1010 and 1020 or MTHS 1020 and 2030 may be substituted.
*See General Education Requirements.
*Spanish is recommended. Two years (through 2020) in the same foreign language are required.
*See advisor.
*Any 3000- or 4000-level geology course
*Select from department-approved list.

MATHEMATICAL SCIENCES

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 that 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 that 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.

Bachelor of Science

Freshman Year
First Semester
3. ECON 2000 Economic Concepts1 or
3. ECON 2110 Principles of Microeconomics1
3. ENGL 1030 Accelerated Composition
4. MTHS 1060 Calculus of One Variable I
3. Arts and Humanities (Non-Lit.) Requirement2
3. Foreign Language Requirement1
16
Second Semester
4. MTHS 1080 Calculus of One Variable II
3. MTHS 1190 Intro. to Discrete Methods or
3. PHYS 1220 Physics with Calculus I
3. Computer Science Requirement4
3. Social Science Requirement2
16

Sophomore Year
First Semester
4. MTHS 2060 Calculus of Several Variables
1. MTHS 2500 Intro. to Mathematical Sciences
3. MTHS 3110 Linear Algebra
3. MTHS 3600 Intermediate Math. Computing
4. Natural Science Requirement3
15
Second Semester
4. MTHS 2080 Intro. to Ordinary Diff. Equations
3. MTHS 3020 Statistics for Science and Engr.
3. Arts and Humanities (Literature) Requirement2
4. Natural Science Requirement3
3. Cross-Cultural Awareness Requirement2
17

Junior Year
First Semester
3. ENGL 3140 Technical Writing
3. MTHS 4000 Theory of Probability
3. MTHS 4400 Linear Programming
3. MTHS 4530 Advanced Calculus I
3. Science Requirement6
15
Second Semester
3. MTHS 4120 Introduction to Modern Algebra
3. MTHS 4540 Advanced Calculus II
3. Emphasis Area Requirement7
3. Science Requirement6
3. Elective
15

Senior Year
First Semester
3. COMM 2500 Public Speaking
3. Capstone Experience6
6. Emphasis Area Requirement7
3. Science and Tech. in Society Requirement7
15
Second Semester
1. MTHS 4920 Professional Development
3. Capstone Experience6
3. Emphasis Area Requirement7
3. Mathematical Sciences Requirement9
3. Elective
13

122 Total Semester Hours

1ECON 2000 or ECON 2110 is recommended, but any other social science course that satisfies the Social Sciences General Education requirement may be taken. ECON 2110 is required for students whose emphasis area is Actuarial Science/Financial Mathematics.
*See General Education Requirements.
*Three credits in any foreign language, including American Sign Language, numbered 1020 or above
*CPSC 1010, 1110, or 2200
*A two-semester sequence selected from BIOL 1010/1050 and 1040/1060; CH 1010 and 1020; PHYS 2210/2230 and 2220/2240; GEOL 1010/1030 and 1030 or 1120/1140.
*ECON 2110 and 4050; CPSC 1020 and 2120; CPSC 2100 and 2210; ECON 2120 and FIN 3110; or any two natural science courses from General Education Natural Science Requirements (labs not required). Actuarial Science/Financial Mathematics requires ECON 2110 and FIN 3110; Operations Research Emphasis Areas requires ECON 2120 and 4050; Computer Science Emphasis Area requires CPSC 1020 and 2120, or 2200 and 2210.
*May be satisfied by: (1) completion of six credits of MTHS 4820; (2) completion of six credits of MTHS 4910 or an approved substitution; or (3) completion of three credits of MTHS 4500 and three credits of an additional course approved by the advisor. Students in Actuarial Science/Financial Mathematics Emphasis Area must take MTHS 4670 and 4410.
*Any 4000-level MTHS course approved by advisor or EXST 4020.

Notes:
1. For graduation, a candidate for the BS degree in Mathematical Sciences will be required to have a C- or better in all prerequisite courses before enrolling in the next MTHS course.
2. A grade of C or better must be earned in all prerequisite courses before enrolling in the next MTHS course.
3. Students who change majors to Mathematical Sciences must have achieved the Minimum Cumulative Grade-Point Average (MCGPA) by Total Credit Hour Level as defined in the Academic Regulations section of the Undergraduate Announcements and must have received a grade of C or better in all MTHS courses taken.

EMPHASIS AREAS

Abstract Mathematics
6. Abstract Mathematics Requirement7
6. Mathematical Sciences Requirement3
12
Actuarial Science/Financial Mathematics
3. ACCT 2040 Accounting Procedures
3. FIN 3120 Financial Management II
3. MTHS 4030 Intro. to Statistical Theory
3. MTHS 4310 Theory of Interest
13
MATHEMATICAL SCIENCES

Bachelor of Arts

Freshman Year

First Semester
3 - ECON 2000 Economic Concepts or ECON 2110 Principles of Microeconomics
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Foreign Language Requirement
1 - Elective
14

Second Semester
4 - MTHS 1080 Calculus of One Variable II
3 - MTHS 1190 Intro. to Discrete Methods or MTHS 1290 Prob. Solving in Discr. Math.
3 - Computer Science Requirement
3 - Foreign Language Requirement
3 - Social Science Requirement
16

Sophomore Year

First Semester
4 - MTHS 2060 Calculus of Several Variables
3 - MTHS 2500 Intro. to Mathematical Sciences
3 - MTHS 3600 Intro. to Ordinary Diff. Equations
3 - EDSC 4370 Technology in Sec. Math.
3 - Arts and Humanities (Literature) Requirement
3 - Minor Requirement or 3 - Second Major Requirement
16

Second Semester
4 - MTHS 4120 Introduction to Modern Algebra
3 - MTHS 4430 Advanced Calculus II
1 - MTHS 4920 Professional Development
3 - Biological Sciences Requirement
3 - Capstone Experience
7
16

Junior Year

First Semester
3 - ECON 2000 Economic Concepts or ECON 2110 Principles of Microeconomics
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Foreign Language Requirement
1 - Elective
14

Second Semester
3 - ECON 2000 Economic Concepts or ECON 2110 Principles of Microeconomics
3 - ENGL 1030 Accelerated Composition
4 - MTHS 1060 Calculus of One Variable I
3 - Foreign Language Requirement
1 - Elective
14

Sophomore Year

First Semester
4 - MTHS 2060 Calculus of Several Variables
3 - MTHS 2500 Intro. to Mathematical Sciences
3 - MTHS 3600 Intro. to Ordinary Diff. Equations
3 - EDSC 4370 Technology in Sec. Math.
3 - Arts and Humanities (Literature) Requirement
3 - Minor Requirement or 3 - Second Major Requirement
16
Senior Year
First Semester
1 - PHYS 3000 Introduction to Research
2 - PHYS 2230 Physics Lab. II
3 - PHYS 2220 Physics with Calculus II
4 - MTHS 1080 Calculus of One Variable II
5 - BIOL 1100 Principles of Biology
6 - Minor Requirement6 or 7
7 - Social Science Requirement1
8 - MTHS 3080 or any 4000-level MTHS course or EXST 4020
15
Second Semester
1 - PHYS 1240 Physics Lab I
2 - PHYS 1220 Physics with Calculus I
3 - PHYS 2250 Experimental Physics I
4 - MTHS 1060 Calculus of One Variable
5 - CH 1020 General Chemistry
6 - Arts and Humanities (Non-Lit.) Requirement1
15
Junior Year
First Semester
1 - PHYS 3220 Mechanics II
2 - PHYS 4650 Thermodynamics and Statistical Mechanics
3 - Emphasis Area Requirement8
4 - PHYS Writing Requirement4
5 - Science Requirement4
15
Second Semester
1 - PHYS 3260 Experimental Physics II
2 - PHYS 3150 Intro. to Computational Physics
3 - PHYS 3210 Mechanics I
4 - Emphasis Area Requirement8
5 - Arts and Humanities (Non-Lit.) Requirement1
15
Sophomore Year
First Semester
1 - Elective
2 - Elective
3 - Arts and Humanities Requirement1
4 - MTHS 4530 Advanced Calculus I
5 - CPSC 1010, 1110, or 2200
6 - See advisor. Select from the following emphasis areas: Chemistry, Computer Science, Engineering, Environmental Engineering, Geology, Mathematical Sciences, or Physics and Astronomy. Twelve credit hours in one of these areas, with at least six at the 3000-4000 level, are required. Note: Requirements for a minor in one of these areas might be satisfied with three additional credits at the 3000-4000 level.
7 - Any 2000-4000 level science course
15
Senior Year
First Semester
1 - PHYS 4010 Senior Thesis
2 - PHYS 4410 Electromagnetics I
3 - PHYS 4550 Quantum Physics I
4 - Arts and Humanities (Literature) Requirement1
5 - Emphasis Area Requirement1
15
Second Semester
1 - PHYS 4420 Electromagnetics II
2 - PHYS 4560 Quantum Physics II
3 - Emphasis Area Requirement1
4 - Social Science Requirement1
15
120 Total Semester Hours

See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.
2Two semesters (through 1020) in the same modern foreign language are required.
3See advisor. Select from the following emphasis areas: Chemistry, Computer Science, Engineering, Environmental Engineering, Geology, Mathematical Sciences, or Physics and Astronomy. Twelve credit hours in one of these areas, with at least six at the 3000-4000 level, are required. Note: Requirements for a minor in one of these areas might be satisfied with three additional credits at the 3000-4000 level.
4ENGL 3040, 3120, 3140, 3150, 3160, 3450, 3460, 3480, ML 4020, or THEA (ENGL) 3470
5MTHS 1080 Calculus of One Variable II or an approved substitute.
6Six credits in any foreign language, including American Sign Language, numbered 2000 or above.
7MTHS 3080, 4080, or any 4000-level MTHS course or EXST 4020
8May be satisfied by (1) completion of six credits of MTHS 4920; (2) completion of six credits of MTHS 4910 or an approved substitution; (3) completion of three credits of MTHS 4500 and three credits of an additional course approved by advisor; or (4) EDSC 4460 for students seeking a double major in Secondary Education-Mathematics.

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 curriculum provides 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.

The undergraduate Physics curriculum provides 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.

The undergraduate Physics curriculum provides 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.
Second Semester  
4 - MTHS 2080 Intro. to Ordinary Diff. Equations  
3 - PHYS 3110 Intro. to Meth. of Theoretical Phys.  
3 - PHYS 3260 Experimental Physics II or  
   - Science Requirement  
4 - Biophysics Requirement  
14

Junior Year  
First Semester  
3 - PHYS 3120 Methods of Theoretical Physics II  
3 - PHYS 3150 Intro. to Computational Physics  
3 - PHYS 3210 Mechanics I  
3 - Biophysics Requirement  
4 - Foreign Language Requirement  
16

Second Semester  
3 - PHYS 3220 Mechanics II  
3 - PHYS 4650 Thermodynamics and Statistical Mechanics  
3 - Biophysics Requirement  
4 - Foreign Language Requirement  
3 - Oral Communication Requirement  
16

Senior Year  
First Semester  
4 - MTHS 2060 Calculus of Several Variables  
3 - PHYS 2220 Physics with Calculus III  
1 - PHYS 3000 Introduction to Research  
3 - PHYS 3250 Experimental Physics I  
4 - Foreign Language Requirement  
15

Second Semester  
3 - HIST 1720 The West and the World I or  
   - HIST 1730 The West and the World II  
3 - PHYS 4420 Electromagnetics II  
3 - Arts and Humanities (Non-Lit.) Requirement  
15

Freshman Year  
First Semester  
4 - CH 1010 General Chemistry  
3 - ENGL 1030 Accelerated Composition  
4 - MTHS 1060 Calculus of One Variable I  
3 - PHYS 1220 Physics with Calculus I  
1 - PHYS 1240 Physics Lab. I  
15

Second Semester  
4 - CH 1020 General Chemistry  
4 - MTHS 1080 Calculus of One Variable II  
3 - PHYS 2210 Physics with Calculus II  
1 - PHYS 2230 Physics Lab. II  
3 - Arts and Humanities (Non-Lit.) Requirement  
15

Sophomore Year  
First Semester  
4 - MTHS 2080 Intro. to Ordinary Diff. Equations  
3 - PHYS 3110 Intro. to Meth. of Theoretical Phys.  
3 - Foreign Language Requirement  
4 - Foreign Language Requirement  
3 - Oral Communication Requirement  
15

Second Semester  
4 - MTHS 2060 Calculus of Several Variables  
3 - PHYS 2220 Physics with Calculus III  
1 - PHYS 3000 Introduction to Research  
3 - PHYS 3250 Experimental Physics I  
4 - Foreign Language Requirement  
15

Junior Year  
First Semester  
3 - PHYS 3150 Intro. to Computational Physics  
3 - PHYS 3210 Mechanics I  
3 - Foreign Language Requirement  
3 - Minor Requirement  
3 - Physics Requirement  
3 - Elective  
15

Second Semester  
3 - HIST 1720 The West and the World I or  
   - HIST 1730 The West and the World II  
3 - Arts and Humanities (Literature) Requirement  
3 - Minor Requirement  
3 - Physics Requirement  
3 - Elective  
15

120 Total Semester Hours  

1See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.  
2Four semesters (through 2020) in the same modern foreign language are required.  
3ENGL 3040, 3120, 3140, 3150, 3160, 3450, 3460, 3480 ML 4020, or THEA (ENGL) 3470.  
4See advisor.  
5Any 3000- or 4000-level physics course

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.
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
Art
Athletic Leadership—*not open to Marketing majors.*
Biochemistry
Biological Sciences
Business Administration
Chemistry
Cluster
Communication Studies
Computer Science—*not open to Computer Information Systems majors*
Crop and Soil Environmental Science
Digital Production Arts
East Asian Studies
Economics
Education
English
Entomology
Entrepreneurship
Environmental Engineering
Environmental Science and Policy
Equine Business
Film Studies
Financial Management
Food Science
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 39-42 for details.