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

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

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

ENGINEERING PROGRAMS
The Bachelor of Science engineering degree programs in Biosystems Engineering, Ceramic and Materials Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, and Mechanical Engineering are each accredited by the Engineering Accreditation Commission (EAC) of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700. The new BS degree programs in Bioengineering and Environmental Engineering are designed to meet ABET requirements and will be submitted to ABET for accreditation review when eligible. Beginning with the 2011-2012 curriculum year, the BS in Ceramic and Materials Engineering degree will be called the BS in Materials Science and Engineering.

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
2 - CES 102 Engineering Disciplines and Skills
3 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - General Education Requirement1
16
Second Semester
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
2-3 - Departmental Freshman Engineering Req.2
3-4 - Departmental Science Requirement2
3 - General Education Requirement1
15-17

1See Policy on General Education Requirements for Engineering Curricula below.
2See advisor.

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

2-3 - Departmental Freshman Engineering Req.
2 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
2-3 - Departmental Freshman Engineering Req.

In addition, the student must have the minimum grade-point ratio specified by the engineering degree program for admission.

Students should initiate a change-of-major request prior to the registration period during the semester when they expect to complete the freshman curriculum. Students who fail to meet the requirements for admission into a degree program may remain in General Engineering until those requirements are met; however, General Engineering majors are not permitted to take 300- or 400-level engineering courses. Engineering departments may allow General Engineering majors to enroll in selected 200-level engineering courses (policy varies by department). Students admitted into an engineering degree 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 curriculum. Further, the program of study must include educational experiences addressing the intersection of science and technology with society and cross-cultural awareness.

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

Electives for Engineering Curricula
Advisors must approve any course taken for elective credit in the engineering curriculum. Courses excluded for elective credit include PHYS 200, 207/209, 208/210.

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

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

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

BIOENGINEERING

Bachelor of Science

The undergraduate program in Bioengineering is built upon a rigorous engineering science foundation that is, in turn, based upon a broad curriculum of applied and life sciences, mathematics, electives in humanities, social science, and design. Students select a formal focus that concentrates in a subfield of interest in bioengineering: 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 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Second Semester
4 - CH 102 General Chemistry
3 - ENGR 141 Programming and Problem Solving
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I 1
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Biology Requirement1

Sophomore Year

First Semester
3 - BIO E 201 Intro. to Biomedical Engineering
2 - E C E 202 Logic and Computing Devices
3 - E C E 202 Electric Circuits I
1 - E C E 209 Logic and Computing Devices Lab.
1 - E C E 211 Electrical Engineering Lab. I
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II 1

Second Semester
3 - C E 201 Statics
1 - E C E 212 Electrical Engineering Lab. II
3 - E C E 262 Electric Circuits II
3 - MS& E 210 Introduction to Materials Science
4 - MTHSC 208 Intro. to Ordinary Diff. Equations

Junior Year

First Semester
4 - CH 201 Survey of Organic Chemistry2
1 - E C E 311 Electrical Engineering Lab. III
3 - E C E 320 Electronics I
3 - E C E 330 Signals, Systems, and Transforms
3 - E C E 380 Electromagnetics
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Second Semester
3 - BIO E 302 Biomaterials
3 - BIO E 370 Bioinstrumentation and Bioimaging
3 - BIOCH 305 Essential Elements of Biochem.
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Bioengineering or E C E Technical Requirement1

Senior Year

First Semester
3 - BIO E 320 Biomaterials
3 - BIO E 401 Bioengineering Design Theory
4 - BIOSC 315 Functional Human Anatomy
3 - BIO E 461 Cell Biology
2 - BIO E 462 Cell Biology Lab.

Second Semester
1 - BIO E 400 Senior Seminar
3 - BIO E 403 Applied Biomedical Design
3 - BIO E 448 Tissue Engineering
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
6 - Bioengineering or E C E Technical Requirement1

128 Total Semester Hours

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

BIOMATERIALS

CONCENTRATION

Freshman Year

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

Second Semester
4 - CH 102 General Chemistry
3 - ENGR 141 Programming and Problem Solving
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I 1
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
1 - Biology Requirement1

Sophomore Year

First Semester
3 - BIO E 201 Intro. to Biomedical Engineering
4 - CH 201 Survey of Organic Chemistry2
4 - CH 202 Survey of Inorganic Chemistry
3 - MS&E 210 Introduction to Materials Science
4 - MTHSC 208 Intro to Ordinary Diff. Equations

Second Semester
3 - BIO E 320 Biomaterials
3 - BIO E 370 Bioinstrumentation and Bioimaging
3 - BIOCH 305 Essential Elements of Biochem.
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Bioengineering or E C E Technical Requirement1

Junior Year

First Semester
3 - BIO E 201 Intro. to Biomedical Engineering
4 - CH 201 Survey of Organic Chemistry2
4 - CH 202 Survey of Inorganic Chemistry
3 - MS&E 319 Materials Processing I
3 - MS&E 326 Thermodynamics of Materials
3 - MS&E 327 Transport Phenomena

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The Ecological Engineering area equips students to apply engineering, agricultural, and environmental sciences to assess and control the impact of human activities on the biosphere.

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 careers should consider graduate study and/or medical school.

Additional information is available from the departmental offices or at: http://www.clemson.edu/casfs/departments/biosystemseng/index.html.

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

Second Semester
2 - CH 102 General Chemistry
2 - ENGR 130 Engineering Fundamentals
2 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Sophomore Year
First Semester
2 - B E 210 Intro. to Biosystems Engineering
3 - C E 201 Statics
4 - MTHSC 206 Calculus of Several Variables
5 - PHYS 221 Physics with Calculus II
4-5 - Biology Requirement1

Second Semester
2 - B E 212 Fundamentals of Biosystems Engr.
2 - C E 208 Dynamics1
2 - E G 210 Computer-Aided Design and Engineering Applications
3 - M E 310 Thermodynamics and Heat Transfer or
3 - CH E 220 Chem. Engr. Thermodynamics I
4 - MICRO 305 General Microbiology
4 - MTHSC 208 Intro. to Ordinary Diff. Equations

Junior Year
First Semester
2 - B E 222 Geomeasurements
2 - B E 410 Biol. Kinetics and Reactor Modeling
3 - CH 223 Organic Chemistry
1 - CH 227 Organic Chemistry Laboratory
2 - E C E 307 Basic Electrical Engineering
3 - Mechanics of Materials Requirement1
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Second Semester
3 - B E 322 Small Watershed Hydrology and Sedimentology
3 - B E 412 Heat and Mass Transport in B E
4 - B E 415 Instrumentation and Control for Biosystems Engineers
3 - B E 438 Bioproces Design
4 - C E 341 Introduction to Fluid Mechanics

BIOPROCESS ENGINEERING EMPHASIS AREA
Senior Year
First Semester
3 - B E 428 Biochemical Engineering
2 - B E 474 Biosystems Engr. Design/Project Mgt.
3 - BIOC 305 Essential Elements of Biochemistry
2 - BIOSC 334 Biological Chemistry Lab. Techniques
3 - BIOSC 441 Ecology
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Second Semester
2 - B E 475 Biosystems Engr. Capstone Design
6 - Engineering Requirement1
3 - Life Science Requirement1
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

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.

2M E 201 may be substituted for C E 201 and 208
3BIOL 103/105 or 110
4C E 206 or M E 302

BIOSYSTEMS ENGINEERING Bachelor of Science
The principal objective of the Biosystems Engineering program is to educate and prepare students for a wide range of engineering endeavors involving biological entities. Two main areas are supported: engineering for management of natural resources and the environment and engineering for production of value-added products from bioprocessing technologies.

Biosystems engineers work at the interface between engineering and life sciences and must be knowledgeable in both disciplines. In addition to the common objectives of all engineering programs listed on page 87, Biosystems Engineering students should achieve familiarity with both biosystems concentrations, experience an interdisciplinary education, and develop a career goal of professional recognition and licensure.

Students develop specialization in one of two emphasis areas. The Bioproces Engineering area equips students to apply engineering and biological sciences to problem solving for biological systems and production of value-added bioproducts in a wide range of industries.
## CHEMICAL ENGINEERING

### Bachelor of Science

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

Chemical engineering is based on chemistry, biology, physics, and mathematics. The curriculum at Clemson includes classroom and laboratory instruction and emphasizes broadly applicable fundamental principles and current technology to prepare graduates for professional practice and professional growth. 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.

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

### 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 ratio 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.

### Notes

1. Biosystems Engineering students are allowed to enroll in upper-level B E courses only when the following prerequisites have been completed with C or better: C E 321, 352, 402, 406, 482, EES & 401, 402, 410, 430, 480, 484, 485, 486, 1 E 354, GEOL 421, or any other pre-approved engineering course. Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Engineering Requirements.

2. Any BIOCH, BIOSC, BIOL, CSENV, GEN, MICRO or W F B course at the 300 level or higher.

### ECOLOGICAL ENGINEERING

#### EMPHASIS AREA

### Senior Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Semester</td>
<td>2 - B E 474 Biosystems Engr. Design/Project Mgt.</td>
</tr>
<tr>
<td></td>
<td>3 - BIOSC 441 Ecology</td>
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<tr>
<td></td>
<td>3 - Ecological Requirement</td>
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<tr>
<td></td>
<td>3 - Engineering Requirement</td>
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<tr>
<td></td>
<td>3 - Arts and Humanities Requirement or Social Science Requirement</td>
</tr>
<tr>
<td>16</td>
<td>129 Total Semester Hours</td>
</tr>
<tr>
<td></td>
<td>3 - Emphasis Area Requirement</td>
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<td>3 - Social Science Requirement</td>
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### Sophomore Year

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<tr>
<th>Semester</th>
<th>Courses</th>
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<tbody>
<tr>
<td></td>
<td>2 - B E 421 Engineering Systems for Soil Water Mgt.</td>
</tr>
<tr>
<td></td>
<td>3 - B E 424 Ecological Engineering</td>
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<tr>
<td></td>
<td>2 - B E 475 Biosystems Engr. Capstone Design</td>
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<td>3 - Ecological Requirement</td>
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<td></td>
<td>3 - Engineering Requirement</td>
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<td></td>
<td>3 - Social Science Requirement</td>
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<tr>
<td>16</td>
<td>175 Total Semester Hours</td>
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### Junior Year

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<tr>
<th>Semester</th>
<th>Courses</th>
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<tbody>
<tr>
<td></td>
<td>3 - CH 224 Organic Chemistry</td>
</tr>
<tr>
<td></td>
<td>1 - CH 229 Organic Chemistry Lab.</td>
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<tr>
<td></td>
<td>3 - CH 220 Chemical Engr. Thermodynamics I</td>
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<tr>
<td></td>
<td>4 - CH E 230 Fluids/Heat Transfer</td>
</tr>
<tr>
<td></td>
<td>4 - MTHSC 208 Intro. to Ordinary Diff. Equations</td>
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<td>175 Total Semester Hours</td>
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</table>

### Senior Year

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<tr>
<th>Semester</th>
<th>Courses</th>
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<tbody>
<tr>
<td>Me, E 321 E 340, 410, 413, 423, 443, 446, CSENV 202, ENTOX 437, F N R 466, GEOL 408</td>
<td></td>
</tr>
<tr>
<td>Me, E 334, 408, 401, 417, 422, 440, 464, 473, 484, C E 321, 352, 402, 406, 482, EES &amp; 401, 402, 410, 430, 480, 484, 485, 486, 1 E 354, GEOL 421, or any other pre-approved engineering course. Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Engineering Requirements.</td>
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<tr>
<td>16</td>
<td>175 Total Semester Hours</td>
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### Sophomore Year

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<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
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<tbody>
<tr>
<td>3 - CH 332 Physical Chemistry</td>
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<tr>
<td>1 - CH 340 Physical Chemistry Lab.</td>
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<tr>
<td>3 - CH 321 Chemical Engr. Thermodynamics II</td>
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<tr>
<td>4 - CH E 330 Mass Transfer and Separation Proc.</td>
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<tr>
<td>3 - Arts and Humanities Requirement or Social Science Requirement</td>
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<tr>
<td>3 - Emphasis Area Requirement</td>
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<td>16</td>
<td>175 Total Semester Hours</td>
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### Junior Year

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<tr>
<th>Semester</th>
<th>Courses</th>
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<tr>
<td>Me, E 321 E 340, 410, 413, 423, 443, 446, CSENV 202, ENTOX 437, F N R 466, GEOL 408</td>
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</tr>
<tr>
<td>Me, E 334, 408, 401, 417, 422, 440, 464, 473, 484, C E 321, 352, 402, 406, 482, EES &amp; 401, 402, 410, 430, 480, 484, 485, 486, 1 E 354, GEOL 421, or any other pre-approved engineering course. Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Engineering Requirements.</td>
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<td>16</td>
<td>175 Total Semester Hours</td>
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### Senior Year

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<tr>
<th>Semester</th>
<th>Courses</th>
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<tbody>
<tr>
<td>Me, E 407 Unit Operations Lab. II</td>
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<tr>
<td>Me, E 431 Chemical Process Design I</td>
<td></td>
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<tr>
<td>Me, E 443 Chemical Engr. Senior Seminar I</td>
<td></td>
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<tr>
<td>Me, E 450 Chemical Reaction Engineering</td>
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<tr>
<td>3 - Arts and Humanities Requirement or Social Science Requirement</td>
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<tr>
<td>3 - Emphasis Area Requirement</td>
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<tr>
<td>16</td>
<td>175 Total Semester Hours</td>
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</tbody>
</table>

### Freshman Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
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</thead>
<tbody>
<tr>
<td>1 - CH 101 General Chemistry</td>
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<tr>
<td>3 - ENGL 103 Accelerated Composition</td>
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<tr>
<td>4 - MTHSC 106 Calculus of One Variable I</td>
<td></td>
</tr>
<tr>
<td>3 - Arts and Humanities Requirement or Social Science Requirement</td>
<td></td>
</tr>
<tr>
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<td></td>
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<tr>
<td>16</td>
<td>175 Total Semester Hours</td>
</tr>
</tbody>
</table>
129 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 advisor for details. Nine credit hours devoted to completion of an emphasis area or approved minor are required. Emphasis areas are Applied Engineering, Mathematics, and Science; Biomedical Science and Engineering, Business Management; Environmental Engineering, Polymers, Materials; Energy Studies.

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

BIOMOLECULAR ENGINEERING CONCENTRATION

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

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

Sophomore Year
First Semester
5 - BIOL 110 Principles of Biology I
3 - CH 223 Organic Chemistry
4 - CH E 211 Intro. to Chemical Engineering
4 - MTHSC 206 Calculus of Several Variables
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Second Semester
3 - BIOC 305 Essential Elements of Biochemistry
2 - BIOSC 434 Biological Chem. Lab. Techniques
3 - CH 224 Organic Chemistry
1 - CH 229 Organic Chemistry Lab.
3 - CH E 220 Chemical Engr. Thermodynamics I
4 - CH E 230 Fluids/Heat Transfer

Junior Year
First Semester
3 - BIO E 302 Biomaterials
3 - BIOC 430 Physical Approach to Biochemistry
3 - CH E 307 Unit Operations Lab. I
3 - CH E 319 Engineering Materials
4 - MTHSC 208 Intro. to Ordinary Diff. Equations

Second Semester
3 - BMOLE 425 Biomolecular Engineering
3 - CH E 321 Chemical Engr. Thermodynamics II
4 - CH E 330 Mass Transfer and Separation Proc.
3 - PHYS 221 Physics with Calculus II
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Senior Year
First Semester
3 - CH E 407 Unit Operations Lab. II
3 - CH E 431 Chemical Process Design I
1 - CH E 443 Chemical Engr. Senior Seminar I
1 - CH E 450 Chemical Reaction Engineering
3 - EX ST 411 Statistical Methods for Process Development and Control
3 - Engineering Requirement2

Second Semester
3 - CH E 355 Process Dynamics and Control
3 - CH E 433 Process Design II
1 - CH E 444 Chemical Engr. Senior Seminar II
6 - Arts and Humanities Requirement1 or
6 - Social Science Requirement1
3 - Engineering Requirement2

131 Total Semester Hours

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 ratio of 2.0 or higher.

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

CIVIL ENGINEERING

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

The Bachelor of Science degree program in Civil Engineering includes the common educational goals listed on page 87 for the College of Engineering and Science. The complete objectives of the program can be found at www.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, hydraulic, 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. During the senior year, students can select from available emphasis areas that serve to strengthen their undergraduate background.

The Civil Engineering program prepares students to work immediately upon graduation in most areas of civil engineering or to pursue graduate degrees. Students are also exposed to issues related to professional practice, including professional registration, lifelong learning, and communication and team skills. Because a concerned society demands a realistic consideration of the impacts of engineering projects, civil engineering students are also educated in the broad areas of the humanities and social sciences.
Information on the program and its objectives is available at www.clemson.edu/ces/departments/ece/.

### Freshman Year

#### First Semester
- 3 - ECE 102 Engineering Disciplines and Skills
- 3 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - Arts and Humanities Requirement or Social Science Requirement
- 1 - CEE 151 Construction and Materials
- 4 - CEE 111 Intro. to Engineering Materials
- 3 - CEE 150 Intro. to Civil Engineering
- 3 - CEE 106 Intro. to Geoenvironmental Engineering
- 1 - CEE 110 Intro. to Structural Engineering
- 1 - CEE 112 Intro. to Construction Engineering

#### Second Semester
- 3 - ECE 201 Logic and Computing Devices
- 3 - ECE 202 Electric Circuits I
- 1 - ECE 209 Logic and Computing Devices Lab.
- 1 - ECE 211 Electrical Engineering Lab. I
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 6 - Arts and Humanities Requirement or Social Science Requirement
- 1 - COMM 101 Intro. to Communications

### Sophomore Year

#### First Semester
- 3 - CPSC 111 Elementary Computer Programming in C/C++
- 2 - ECE 201 Logic and Computing Devices
- 3 - ECE 230 Communication Circuit
- 1 - ECE 211 Electrical Engineering Lab. II
- 1 - ECE 273 Computer Organization
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations

#### Second Semester
- 3 - ECE 212 Electrical Engineering Lab. II
- 3 - ECE 222 Systems Programming Concepts for Computer Engineering
- 3 - ECE 262 Electric Circuits II
- 3 - ECE 272 Computer Organization
- 1 - ECE 273 Computer Organization Lab.
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II

### Junior Year

#### First Semester
- 3 - CEE 223 Computer Systems Engineering
- 1 - CEE 311 Electrical Engineering Lab. III
- 3 - CEE 320 Electronics I
- 3 - CEE 330 Signals, Systems, and Transforms
- 3 - ECE 371 Microcontroller Interfacing
- 1 - CEE 372 Microcontroller Interfacing Lab.
- 3 - MTHSC 311 Linear Algebra
- 1 - CEE 317 Random Signal Analysis
- 3 - ECE 322 Intro. to Operating Systems
- 3 - ECE 327 Digital Computer Design
- 3 - ECE 352 Programming Systems

#### Second Semester
- 3 - CEE 419 Discrete Math. Structures I
- 3 - MTHSC 419 Discrete Math. Structures I
- 3 - ECE 352 Programming Systems
- 3 - ECE 327 Digital Computer Design
- 3 - ECE 322 Intro. to Operating Systems

### Senior Year

#### First Semester
- 3 - COMM 150 Intro. to Human Comm. or COMM 250 Public Speaking
- 3 - ECE 409 Continuous and Discrete Sys. Design
- 2 - ECE 495 Integrated System Design I
- 3 - ENGL 314 Technical Writing
- 6 - Computer Engineering Technical Requirement

#### Second Semester
- 2 - ECE 496 Integrated System Design II
- 3 - Arts and Humanities (Literature) Requirement
- 3 - Computer Engineering Technical Requirement
- 3 - Computer Engineering Technical Depth Req.
- 3 - Special Requirement

127 Total Semester Hours

1. Select from department-approved list.
2. See advisor approved list.
3. Three additional credits of approved Arts or Social Science courses, or ECO 308 or 408, or one additional three-credit, 400-level course from the departmental Computer Engineering Technical Requirement list or Electrical Engineering Technical Requirement list, or one additional course selected from MTHSC 412, 414, 415, 440, 441, or 443.

**Notes:**
1. A student is allowed to enroll in any ECE course (excluding ECE 307, 308, 309) only when all prerequisites have been passed with a grade of C or better.
2. All Computer Engineering students must have a cumulative engineering grade-point ratio of 2.0 to enroll in any 300- or 400-level ECE course.
3. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any ECE course.

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**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.
### Senior Year

**First Semester**
- COMM 150 Intro. to Human Comm. or
  - COMM 250 Public Speaking
- E C E 409 Continuous and Discrete Syst. Des.
- E C E 427 Communications Systems
- E C E 495 Integrated Systems Design I
- E C E 402 Electrical Engineering Technical Req.¹

**Second Semester**
- E C E 496 Integrated System Design II
- Arts and Humanities Requirement² or
  - Social Science Requirement²
- Arts and Humanities Requirement² or
  - Social Science Requirement²
- Electrical Engineering Technical Req.¹
- Electrical Engineering Technical Depth Req.¹
- Special Requirement⁶

126 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 may enroll in E C E 222 for a common semester with Computer Engineering. Those not selecting this option should complete the Electrical Engineering Technical Requirement in the senior year.

³Select from department-approved list.

⁴Three additional credits of approved Arts and Humanities or Social Science courses; or E L E 301 or 401; or any additional three-credit, 400-level course from the departmental Computer Engineering Technical Requirement list or Electrical Engineering Technical Requirement list, or one additional course selected from E C E 311, 412, 419, 434, 435, 440, 441, or 453.

### Sophomore Year

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

**Second Semester**
- E C E 212 Electrical Engineering Lab. II
- E C E 262 Electric Circuits II
- E C E 272 Computer Organization
- E C E 273 Computer Organization Laboratory
- MTHSC 208 Intro. to Ordinary Diff. Equations
- Arts and Humanities Requirement² or
  - Social Science Requirement² or
  - Electrical Engineering Technical Req.²

15

### Junior Year

**First Semester**
- E C E 311 Electrical Engineering Lab. III
- E C E 320 Electronics I
- E C E 330 Signals, Systems, and Transforms
- E C E 360 Electric Power Engineering
- E C E 380 Electromagnetics
  - Advanced Mathematics Requirement⁴

16

**Second Semester**
- E C E 312 Electrical Engineering Lab. IV
- E C E 317 Random Signal Analysis
- E C E 321 Electronics II
- E C E 371 Microcontroller Interfacing
- E C E 372 Microcontroller Interfacing Lab.
- E C E 381 Fields, Waves, and Circuits
- ENGL 314 Technical Writing

17

### Senior Year

**First Semester**
- E E&S 402 Water and Wastewater Treatment
  - E E&S 403 Water and Wastewater Treat. Lab
  - MICRO 305 General Microbiology
  - Engineering Economics Requirement³
  - Arts and Humanities Requirement² or
  - Social Science Requirement²
  - Statistics Requirement⁶

16

**Second Semester**
- E C E 341 Introduction to Fluid Mechanics
  - E E&S 484 Municipal Solid Waste Mgt.
  - E E&S 485 Hazardous Waste Management
  - M E 310 Thermodynamics and Heat Transfer
  - Earth Science Requirement⁷

17

### Sophomore Year

**First Semester**
- BIOL 103 General Biology
  - BIOL 105 General Biology Lab
  - C E 201 Statics
  - E E&S 201 Environmental Engineering Fund. I
  - MTHSC 206 Calculus of Several Variables
  - PHYS 221 Physics with Calculus II

17

**Second Semester**
- E C E 208 Dynamics
- CH 201 Survey of Organic Chemistry⁴
  - E G 210 Comp.-Aided Design and Engr. Apps.³
  - E E&S 202 Environmental Engineering Fund. II
  - MTHSC 208 Intro. to Ordinary Diff. Equations

16

The curriculum for the Bachelor of Science degree in Environmental Engineering consists of 128-130 credit hours. All students participate in one professional seminar course and complete a capstone design project.

### ENVIRONMENTAL ENGINEERING

**Bachelor of Science**

Our complex world faces many challenges, including contaminated water supplies, hazardous wastes, an increasing population and limited resources. Environmental engineers help to solve many of the environmental problems faced by society using the principles of biology, chemistry, physics, mathematics and earth sciences. An undergraduate degree in environmental engineering opens the door to a variety of rewarding career options. Environmental engineers protect water quality by designing water and wastewater treatment systems; ensure public safety by managing solid, hazardous and radioactive wastes; improve air quality by controlling emissions from mobile and stationary sources; reduce human health risks by tracking contaminants as they move through the environment; clean up toxic waste spills and restore historically contaminated sites; and design a more sustainable future by understanding our use of resources.
Second Semester
3 - EE&S 475 Capstone Design Project
6 - Engineering or Science Requirement
6 - Arts and Humanities Requirement or Social Science Requirement
15

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 PHIL 345 (Environmental Ethics) to fulfill the non-literature humanities requirement.

ENGR 141 may be substituted.

HIST 124 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.

CH 223 and 227 may be substituted.

EG 208 or EG 209 may be substituted.

BIOSC 210 may be substituted. Students selecting this option must make up one hour in any manner they choose.

Select from EX ST 301, GEOL 211 or MTHSC 302.

Select from GEOL 101 and 103, or CSENV 202.

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

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

Freshman Year

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

Second Semester
3 - ENGR 141 Programming and Problem Solving
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement or Social Science Requirement
4 - Lab Science Requirement
17

Sophomore Year

First Semester
1 - I E 200 Sophomore Seminar in I E
4 - I E 201 System Design I
3 - I E 280 Methods of Operational Research I
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. II
16

Second Semester
3 - C E 201 Statics
2 - E G 208 Engineering Graphics with Computer Applications or
2 - E G 209 Introduction to Engineering/Computer Graphics
3 - I E 210 Design and Analysis of Work Systems
3 - I E 384 Engineering Economic Analysis
3 - MS&E 210 Introduction to Materials Science
3 - Arts and Humanities Requirement or Social Science Requirement
3 - Social Science Requirement
17

Junior Year

First Semester
2 - C E 208 Dynamics
3 - I E 360 Design and Control of Industrial Sys.
1 - I E 368 Professional Practice in I E
1 - I E 442 Decision Support Systems in I E
3 - Arts and Humanities Requirement or Social Science Requirement
3 - Mathematics or Natural Science Req.
15

Second Semester
3 - COMM 150 Intro. to Human Comm.
or 3 - COMM 250 Public Speaking
2 - E E 307 Basic Electrical Engineering
1 - E E 309 Electrical Engineering Lab. I
3 - I E 361 Design and Control of Industrial Sys.
3 - I E 381 Methods of Operational Research II
3 - I E 386 Production Planning and Control
15

Senior Year

First Semester
3 - I E 461 Quality Engineering
3 - I E 465 Facilities Planning and Design
4 - I E 482 Systems Modeling
3 - Engineering Requirement
3 - Technical Requirement
16

Second Semester
3 - I E 467 Systems Design II
3 - Arts and Humanities Requirement or Social Science Requirement
3 - Management Requirement
3 - Technical Requirement
12

124 Total Semester Hours

See policy on Humanities and Social Sciences for Engineering curricula.

Select from department-approved list. See advisor.

PHYS 124 may be substituted.

M E 201 may be substituted for C E 201 and 208; E M 202 may be substituted for C E 208.

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, whiteware, polymers, plastics, fibers, textiles, composite materials, and automotive industries. Also included are high performance technology industries such as semiconductor, defense, biomaterials, aerospace, and communication industries. The broad career responsibilities of this discipline require competence in science, engineering, mathematics, and the social sciences. The curriculum develops skills in problem solving, engineering analysis, and design, as well as oral and written communication.

The 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 concentrations in Materials Science and Engineering integrate laboratory with classroom experiences to prepare students for lifelong 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.
Junior Year
First Semester
3 - COMM 250 Public Speaking
3 - MS&E 319 Materials Processing I
3 - MS&E 326 Thermodynamics of Materials
3 - MS&E 327 Transport Phenomena
3 - MS&E 415 Intro. to Polymer Sci. and Engr.
15
Second Semester
3 - EX ST 301 Introductory Statistics or
3 - MTHSC 302 Statistics for Science and Engr.
3 - I E 384 Engineering Economic Analysis
3 - MS&E 328 Phase Diagrams for Materials Processing and Applications
2 - MS&E 342 Structure/Property Laboratory
3 - MS&E 361 Proc. Metals and Their Composites
3 - MS&E 422 Mechanical Behavior of Materials
17
Senior Year
First Semester
3 - MS&E 402 Solid State Materials
3 - MS&E 413 Noncrystalline Materials
3 - MS&E 432 Manufacturing Processes and Sys.
1 - MS&E 441 Manufacturing Laboratory
3 - MS&E 491 Undergraduate Research
13
Second Semester
3 - MS&E 407 Senior Capstone Design
3 - MS&E 416 Electrical Properties of Materials
3 - MS&E 424 Optical Materials and Applications
3 - MS&E 433 Combustion System and Environmental Emissions
1 - MS&E 445 Practice of Materials Engineering
13
124 Total Semester Hours

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 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 461 Accelerated Composition
4 - MTHSC 306 Calculus of One Variable I
3 - Arts and Humanities Requirement\(^2\) or
3 - Social Science Requirement\(^2\)
16
Second Semester
4 - CH 102 General Chemistry
3 - ENGR 141 Programming and Problem Solving
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement\(^2\) or
3 - Social Science Requirement\(^2\)
17
Sophomore Year
First Semester
3 - CH 223 Organic Chemistry
1 - CH 227 Organic Chemistry Laboratory
3 - MS&E 210 Introduction to Materials Science
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - Arts and Humanities Requirement\(^3\) or
3 - Social Science Requirement\(^3\)
15
Second Semester
3 - C E 201 Statics
3 - CH 224 Organic Chemistry
1 - CH 228 Organic Chemistry Laboratory
3 - MS&E 250 Polymer & Fiber Science I
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
16

See advisor.

Junior Year
First Semester
2 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 461 Accelerated Composition
4 - MTHSC 306 Calculus of One Variable I
3 - Arts and Humanities Requirement\(^2\) or
3 - Social Science Requirement\(^2\)
16
Second Semester
4 - CH 102 General Chemistry
3 - ENGR 141 Programming and Problem Solving
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement\(^2\) or
3 - Social Science Requirement\(^2\)
17
Junior Year
First Semester
3 - CH 331 Physical Chemistry
3 - COMM 250 Public Speaking
3 - MS&E 327 Transport Phenomena
3 - MS&E 415 Intro. to Polymer Sci. and Engineering
1 - MS&E 455 Polymer and Fiber Lab.
3 - Arts and Humanities Requirement\(^3\) or
3 - Social Science Requirement\(^3\)
16
Second Semester
3 - CH 332 Physical Chemistry
3 - EX ST 301 Introductory Statistics or
3 - MTHSC 302 Stat. for Science and Engr.
3 - I E 384 Engineering Economic Analysis
3 - MS&E 422 Mechanical Behavior of Materials
3 - MS&E 456 Polymer and Fiber Science II
15

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 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 461 Accelerated Composition
4 - MTHSC 306 Calculus of One Variable I
3 - Arts and Humanities Requirement\(^2\) or
3 - Social Science Requirement\(^2\)
16
Second Semester
4 - CH 102 General Chemistry
3 - ENGR 141 Programming and Problem Solving
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement\(^2\) or
3 - Social Science Requirement\(^2\)
17

See advisor.
### Freshman Year

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

### Second Semester
- 2 - E G 208 Engineering Graphics with Computer Applications
- 3 - ENGR 141 Programming and Problem Solving
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 1 - PHYS 124 Physics Lab. I
- 3 - Arts and Humanities Requirement² or
- 3 - Social Science Requirement²

### Sophomore Year

**First Semester**
- 1 - M E 200 Sophomore Seminar
- 2 - M E 222 Mechanical Engineering Lab. I² or
- 3 - M S & E 210 Intro. to Materials Science²
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II

**Second Semester**
- 2 - E C E 307 Basic Electrical Engineering
- 1 - E C E 309 Electrical Engineering Lab. I
- 3 - M E 202 Foundations of Mechanical Systems
- 3 - M E 203 Found. of Thermal and Fluid Systems
- 2 - M E 222 Mechanical Engineering Lab. I² or
- 3 - M S & E 210 Intro. to Materials Science²
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations

### Junior Year

**First Semester**
- 3 - ENGL 314 Technical Writing
- 3 - M E 302 Mechanics of Materials
- 3 - M E 308 Fluid Mechanics
- 2 - M E 333 Mechanical Engineering Lab. II² or
- 3 - Statistics Requirement²,³
- 3 - MTHSC 365 Numerical Methods for Engineers
- 3 - Arts and Humanities Requirement¹ or
- 3 - Social Science Requirement¹

**Second Semester**
- 3 - M E 303 Thermodynamics
- 3 - M E 304 Heat Transfer
- 3 - M E 305 Model. and Analysis of Dynamic Syst.
- 3 - M E 306 Fundamentals of Machine Design
- 2 - M E 333 Mechanical Engineering Lab. II² or
- 3 - Statistics Requirement²,³

### Senior Year

**First Semester**
- 3 - M E 312 Manufacturing Processes and Their Application
- 3 - M E 401 Mechanical Engineering Design
- 2 - M E 444 Mechanical Engineering Lab. III² or
- 3 - Arts and Humanities Requirement²,³ or
- 3 - Social Science Requirement²,³
- 6 - Technical Requirement⁴

### Bachelor of Science

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

### Bachelor of Arts Curricula

The curricula leading to the Bachelor of Arts degree are designed to meet the needs of students who desire a broad general education. They require a minor (or a second major) as well as the major concentration. A major requires a minimum of 24 credits from courses above the sophomore level, including or in addition to courses specified by the major department. In some major disciplines, certain prescribed courses at the sophomore level are counted toward the 24-credit requirement.
Students have a large degree of flexibility and responsibility in selecting a minor from those listed on page 106. Courses for these minors are to be selected in consultation with the appropriate department.

### CHEMISTRY

**Bachelor of Science**

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

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

### Freshman Year

#### First Semester
- 4 - CH 101 General Chemistry
- 1 - CH 141 Chemistry Orientation
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
  \[= 15\]

#### Second Semester
- 4 - CH 102 General Chemistry
- 2 - CH 152 Chemistry Communication I
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
  \[= 16\]

### Sophomore Year

#### First Semester
- 3 - CH 205 Introduction to Inorganic Chemistry
- 3 - CH 224 Organic Chemistry
- 1 - CH 228 Organic Chemistry Lab.
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 3 - PHYS 222 Physics with Calculus III
- 1 - PHYS 224 Physics Lab. III
  \[= 15\]

#### Junior Year

##### First Semester
- 3 - CH 301 Molecular Biochemistry or
  - 3 - CH 305 Essential Elements of Bioch.
- 3 - CH 313 Quantitative Analysis
- 2 - CH 315 Quantitative Analysis Lab.
- 3 - CH 331 Physical Chemistry
- 1 - CH 339 Physical Chemistry Lab.
- 3 - ENGL 314 Technical Writing
  \[= 15\]

##### Second Semester
- 3 - CH 332 Physical Chemistry
- 1 - CH 340 Physical Chemistry Lab.
- 3 - CH 411 Instrumental Analysis
- 2 - CH 412 Instrumental Analysis Lab.
- 3 - Arts and Humanities (Literature) Requirement\(^1\)
- 3 - Elective
  \[= 15\]

### Senior Year

#### First Semester
- 3 - CH 402 Inorganic Chemistry
- 2 - CH 403 Advanced Synthetic Techniques
- 3 - CH 443 Research Problems
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
- 3 - Chemistry Requirement\(^1\)
  \[= 15\]

#### Second Semester
- 3 - CH 444 Research Problems
- 3 - CH 450 Chemistry Capstone
- 1 - CH 452 Chemistry Communication II
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
- 3 - Chemistry Requirement\(^1\)
- 3 - Elective
  \[= 16\]

122 Total Semester Hours

\(^1\)See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.

\(^2\)One semester (through 102) in any modern foreign language is required.

\(^3\)See advisor.

### CHEMISTRY

**Bachelor of Arts**

### Freshman Year

#### First Semester
- 4 - CH 101 General Chemistry
- 1 - CH 141 Chemistry Orientation
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
  \[= 15\]

#### Second Semester
- 4 - CH 205 Introduction to Inorganic Chemistry
- 2 - CH 152 Chemistry Communication I
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
  \[= 16\]

### Sophomore Year

#### First Semester
- 3 - CH 223 Organic Chemistry
- 1 - CH 227 Organic Chemistry Lab.
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II
- 4 - Foreign Language Requirement\(^2\)
  \[= 15\]

#### Second Semester
- 3 - CH 205 Introduction to Inorganic Chemistry
- 3 - CH 224 Organic Chemistry
- 1 - CH 228 Organic Chemistry Lab.
- 6 - Arts and Humanities Requirement\(^1\) or
  - 6 - Social Science Requirement\(^1\)
- 4 - Foreign Language Requirement\(^2\)
  \[= 17\]

### Junior Year

#### First Semester
- 3 - CH 313 Quantitative Analysis
- 1 - CH 317 Quantitative Analysis Lab.
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
- 3 - Arts and Humanities (Literature) Requirement\(^1\)
- 3 - Foreign Language Requirement\(^2\)
- 3 - Minor Requirement
  \[= 16\]

#### Second Semester
- 3 - CH 331 Physical Chemistry
- 3 - ENGL 314 Technical Writing
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
- 3 - Foreign Language Requirement\(^2\)
- 3 - Minor Requirement
  \[= 15\]

### Senior Year

#### First Semester
- 3 - CH 332 Physical Chemistry
- 3 - CH 341 Technical Writing
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
- 3 - Foreign Language Requirement\(^2\)
- 3 - Minor Requirement
  \[= 15\]

#### Second Semester
- 3 - CH 402 Inorganic Chemistry
- 2 - CH 403 Advanced Synthetic Techniques
- 3 - CH 443 Research Problems
- 3 - Arts and Humanities Requirement\(^1\) or
  - 3 - Social Science Requirement\(^1\)
- 3 - Chemistry Requirement\(^1\)
- 3 - Elective
  \[= 16\]

122 Total Semester Hours

\(^1\)See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.

\(^2\)Four semesters (through 202) of the same modern foreign language are required.

\(^3\)See advisor.
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 ratio of 2.0 or higher.

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

Freshman Year
First Semester
1 - CP SC 291 Seminar in Professional Issues I
3 - CP SC 215 Software Development Foundations
4 - CP SC 207 Discrete Structures for Computing
4 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement
2 - Oral Communication Requirement
3 - Social Science Requirement
16
Second Semester
3 - CP SC 201 Financial Accounting Concepts
3 - CP SC 322 Introduction to Operating Systems
3 - CP SC 372 Introduction to Software Engineering
3 - MTHSC 311 Linear Algebra
3 - Writing Requirement
15

Second Semester
3 - ACCT 202 Managerial Accounting Concepts
3 - CP SC 360 Networks and Network Program.
3 - CP SC 371 Systems Analysis or
3 - MGT 452 Systems Analysis and Design
3 - ECON 211 Principles of Microeconomics
3 - Computer Science Requirement
15
Senior Year
First Semester
3 - CP SC 420 Computer Security Principles or
3 - CP SC 424 System Admin. and Security
3 - CP SC 462 Database Management Systems
3 - CP SC 491 Seminar in Professional Issues II
3 - Business Requirement
3 - Computer Science Requirement
15
Second Semester
3 - MGT 312 Decision Models for Management
3 - MKT 301 Principles of Marketing
3 - Business Requirement
3 - Computer Science Requirement
3 - Information Systems Requirement
15
122 Total Semester Hours
1 Select either the MTHSC 102/207 or 106/108 sequence. Students who select the 106/108 sequence will have satisfied the two elective credits in the freshman year.
2 Select from courses in BIOL, BIOCH, BIOSC, CH, GEOL, MICRO, PHYS, or EN SP 200. At least one course must include a laboratory and satisfy the Natural Science General Education Requirement.
3 See General Education Requirements.
4 MTHSC 301, 302, or 309.
5 Select from Schoolapproved list.
6 Select from 300 level or higher CP SC courses. No more than six credits of CP SC 481 may be used.
7 Select from courses in BIOL, BIOCH, BIOSC, CH, GEOL, MICRO, PHYS, or EN SP 200. At least one course must include a laboratory and satisfy the Natural Science General Education Requirement.
8 MTHSC 301, 302, or 309.
9 Select from Schoolapproved list.
10 Select from 300 level or higher CP SC courses. No more than six credits of CP SC 481 may be used.
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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) 347-7700. Additional information can be found at www.cs.clemson.edu.

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

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

Freshman Year
First Semester
4 - CP SC 101 Computer Science I
3 - ENGL 103 Accelerated Composition
4 - MTHSC 102 Intro. to Mathemat. Analysis 1 and
1 - Elective 1 or
4 - MTHSC 106 Calculus of One Variable I
4 - Natural Science Requirement
15
Second Semester
4 - CP SC 102 Computer Science II
3 - MTHSC 207 Multivariable Calculus and
1 - Elective 2 or
4 - MTHSC 108 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement
3 - Natural Science Requirement
3 - Social Science Requirement
17
Sophomore Year
First Semester
3 - CP SC 207 Discrete Structures for Computing
4 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement
3 - Communication Requirement
3 - Social Science Requirement
16
Second Semester
3 - CP SC 215 Software Development Foundations
4 - CP SC 231 Intro. to Computer Organization
1 - CP SC 291 Seminar in Professional Issues I
3 - MGT 201 Principles of Management
3 - Probability and Statistics Requirement
14
Junior Year
First Semester
3 - ACCT 201 Financial Accounting Concepts
3 - CP SC 322 Introduction to Operating Systems
3 - CP SC 372 Introduction to Software Engineering
3 - MTHSC 311 Linear Algebra
3 - Writing Requirement
15
Second Semester
3 - CP SC 330 Computer Systems Organization
3 - CP SC 360 Networks and Network Program.
3 - CP SC 372 Introduction to Software Engineering
3 - MTHSC 311 Linear Algebra
3 - Social Science Requirement
15
Second Semester
3 - CP SC 322 Introduction to Operating Systems
3 - CP SC 350 Foundations of Computer Science
3 - CP SC 362 Distributed and Cluster Computing
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
3 - Social Science Requirement
15
Senior Year
First Semester
3 - CP SC 352 Programming Languages
6 - Computer Science Requirement^3
3 - Writing Requirement^6
3 - Elective
15
Second Semester
3 - CP SC 491 Seminar in Professional Issues II
3 - Arts and Humanities Requirement^9 or
3 - Social Science Requirement^4
6 - Computer Science Requirement^5
3 - Elective
15
122 Total Semester Hours

Select from School-approved list.

Second Semester
4 - CP SC 102/207 or 106/108 sequence. Students who select the 106/108 sequence will have satisfied the two elective credit in the freshman year. Students interested in computer graphics should select the 106/108 sequence.
1 - Elective^1 or
1 - MTHSC 108 Calculus of One Variable I^1
3 - Arts and Humanities (Non-Lit.) Requirement^3
1 - Foreign Language Requirement^2
15
Sophomore Year
First Semester
3 - CP SC 207 Discrete Structures and Data Structures
4 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement^1
3 - Foreign Language Requirement^2
3 - Oral Communication Requirement^3
16
Second Semester
3 - CP SC 215 Software Development Foundations
4 - CP SC 231 Intro. to Computer Organization
1 - CP SC 291 Seminar in Professional Issues I
3 - Foreign Language Requirement^2
4 - Natural Science Requirement^4
15
Junior Year
First Semester
6 - Computer Science Requirement^5
3 - Mathematical Sciences Requirement^6
3 - Minor Requirement
3 - Natural Science Requirement^4
15
Second Semester
3 - Computer Science Requirement^5
6 - Minor Requirement
3 - Social Science Requirement^3
3 - Writing Requirement^7
15
Senior Year
First Semester
6 - Computer Science Requirement^5
3 - Departmental Humanities Requirement^8
3 - Minor Requirement
3 - Social Science Requirement^1
15
Second Semester
3 - CP SC 491 Seminar in Professional Issues II
3 - Computer Science Requirement^5
3 - Fine Arts Requirement^6
3 - Minor Requirement
3 - Elective
15
121 Total Semester Hours

^2Two-semester sequence in the physical or biological sciences, each including a laboratory, is required. Select from BIOL 103/105, 104/106, 110, 111, CH 101, 102, GEOL 101/103 and 102 or 112/114, PHYS 122/124, 221/223. The six remaining hours may be selected from BIOL, BIOCH, BIOSC, CH, GEOL, MICRO, PHYS, or EN SP 200.

^3Select from General Education Requirements.

^4MTHSC 301, 302 or 309.

^5Select from CP SC courses in A A H, ANTH, ART, CHIN, COMM, DANCE, E A S, ECON, ENGL, FR, GEOG, GER, HIST, HUM, ITAL, JAPN, MUSIC, P A, P A S, PHIL, PO SC, PSYCH, REL, RUSS, SOC, SPAN, THEA, W S.

^6Select from 300-level or higher CP SC courses. No more than six credits of CP SC 481 may be applied to this requirement.

^7Up to three credits of approved 300-level or higher MTHSC or E C E courses may be substituted.

^8Select from School-approved list.

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

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

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

Freshman Year
First Semester
4 - CP SC 101 Computer Science I
3 - ENGL 103 Accelerated Composition
3 - MTHSC 102 Intro. to Mathemat. Analysis^1 and
1 - Elective^1 or
4 - MTHSC 106 Calculus of One Variable I^1
4 - Foreign Language Requirement^2
15
Second Semester
4 - CP SC 102 Computer Science II
3 - MTHSC 207 Multivariable Calculus^1 and
1 - Elective^1 or
4 - MTHSC 108 Calculus of One Variable II^1
3 - Arts and Humanities (Non-Lit.) Requirement^3
1 - Foreign Language Requirement^2
15
Sophomore Year
First Semester
3 - CP SC 207 Discrete Structures and Data Structures
4 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement^1
3 - Foreign Language Requirement^2
3 - Oral Communication Requirement^3
16
Second Semester
3 - CP SC 215 Software Development Foundations
4 - CP SC 231 Intro. to Computer Organization
1 - CP SC 291 Seminar in Professional Issues I
3 - Foreign Language Requirement^2
4 - Natural Science Requirement^4
15
Junior Year
First Semester
6 - Computer Science Requirement^5
3 - Mathematical Sciences Requirement^6
3 - Minor Requirement
3 - Natural Science Requirement^4
15
Second Semester
3 - Computer Science Requirement^5
6 - Minor Requirement
3 - Social Science Requirement^3
3 - Writing Requirement^7
15
Senior Year
First Semester
6 - Computer Science Requirement^5
3 - Departmental Humanities Requirement^8
3 - Minor Requirement
3 - Social Science Requirement^1
15
Second Semester
3 - CP SC 491 Seminar in Professional Issues II
3 - Computer Science Requirement^5
3 - Fine Arts Requirement^6
3 - Minor Requirement
3 - Elective
15
121 Total Semester Hours

Select either the MTHSC 102/207 or 106/108 sequence. Students who select the 106/108 sequence will have satisfied the two elective credits in the freshman year. Students interested in computer graphics should select the 106/108 sequence.

Four semesters (through 202) in the same modern foreign language are required.

Select from School-approved list.

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

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

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

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

**Freshman Year**

**First Semester**
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 3 - GEOL 105 Physical Geology
- 1 - GEOL 105 Physical Geology Lab.
- 4 - MTHSC 106 Calculus of One Variable I

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

**Sophomore Year**

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

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

**Junior Year**

**First Semester**
- 3 - EN SP 200 Intro. to Environmental Science
- 4 - GEOL 302 Structural Geology
- 3 - GEOL 316 Igneous and Metamorphic Petrol.
- 1 - GEOL 303 Physical Geology Lab.
- 4 - MTHSC 106 Calculus of One Variable I

**Second Semester**
- 4 - GEOL 392 Research Methods II
- 3 - GEOL 492 Research Synthesis II
- 3 - Geology Requirement
- 2 - Elective

122 Total Semester Hours

**Senior Year**

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

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

122 Total Semester Hours

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

3Select from department-approved list.

**ENVIRONMENTAL SCIENCE CONCENTRATION**

**Freshman Year**

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

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

**Sophomore Year**

**First Semester**
- 3 - BIOL 103 General Biology I
- 1 - BIOL 105 General Biology Lab. I
- 3 - GEOL 205 Mineralogy and Intro. Petrology
- 2 - GEOL 208 Min. and Intro. Petrography Lab.
- 4 - GEOL 211 Geoanalysis I
- 1 - GEOL 291 Introduction to Research I
- 3 - Arts and Humanities (Literature) Requirement

**Second Semester**
- 3 - BIOL 104 Environmental Geology
- 4 - GEOL 302 Structural Geology
- 3 - GEOL 316 Igneous and Metamorphic Petrol.
- 2 - Elective

122 Total Semester Hours

**Junior Year**

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

**Second Semester**
- 3 - GEOL 392 Research Methods II
- 9 - Environmental Science Requirement
- 3 - Social Science Requirement

**Summer**
- 3 - Field Experience

**HYDROGEOLOGY CONCENTRATION**

**Freshman Year**

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

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

**Sophomore Year**

**First Semester**
- 3 - BIOL 103 General Biology I
- 1 - BIOL 105 General Biology Lab. I
- 3 - GEOL 205 Mineralogy and Intro. Petrology
- 2 - GEOL 208 Min. and Intro. Petrography Lab.
- 4 - GEOL 211 Geoanalysis I
- 1 - GEOL 291 Introduction to Research I
- 3 - Arts and Humanities (Literature) Requirement

**Second Semester**
- 3 - BIOL 104 Environmental Geology
- 4 - GEOL 302 Structural Geology
- 3 - GEOL 316 Igneous and Metamorphic Petrol.
- 2 - Elective

122 Total Semester Hours

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

3Select from department-approved list.

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.
Sophomore Year
First Semester
3 - GEOL 205 Mineralogy and Intro. Petrology
1 - GEOL 207 Mineral. and Intro. Petrology Lab.
4 - GEOL 211 Geoanalysis I
1 - GEOL 291 Introduction to Research I
3 - Arts and Humanities (Literature) Requirement
3 - Technical Requirement
15
Second Semester
4 - GEOL 212 Geoanalysis II
1 - GEOL 292 Introduction to Research II
3 - GEOL 300 Environmental Geology
3 - PHYS 221 Physics with Calculus I
1 - PHYS 24 Physcis Lab. I
3 - Social Science Requirement
15
Junior Year
First Semester
4 - GEOL 302 Structural Geology
2 - GEOL 391 Research Methods I
3 - GEOL 408 Geohydrology
3 - PHYS 221 Physics with Calculus II
3 - Geology Requirement
15
Second Semester
4 - GEOL 313 Sedimentology and Stratigraphy
3 - GEOL 318 Introduction to Geochemistry
2 - GEOL 392 Research Methods II
3 - Social Science Requirement
3 - Technical Requirement
15
Summer
6 - GEOL 475 Summer Geology Field Camp
Senior Year
First Semester
3 - GEOL 421 GIS Applications in Geology
3 - GEOL 491 Research Synthesis I
3 - Geology Requirement
3 - Technical Requirement
12
Second Semester
3 - EE&S 401 Environmental Engineering
4 - GEOL 409 Subsurface Methods
3 - GEOL 492 Research Synthesis II
3 - Technical Requirement
13
121 Total Semester Hours
*See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Requirement.
**MTHSC 206 and 208 or 301 or EX ST 301 may be substituted.
†Select from department-approved list.
‡Any 300- or 400-level geology course

GEOLOGY
Bachelor of Arts
Freshman Year
First Semester
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
3 - GEOL 101 Physical Geology
1 - GEOL 103 Physical Geology Lab.
3 - Mathematics Requirement
1 - Elective
14
Second Semester
4 - CH 102 General Chemistry
3 - GEOG 103 World Regional Geography
4 - GEOL 102 Earth History
3 - Mathematics Requirement
1 - Elective
16
Sophomore Year
First Semester
3 - BIOL 103 General Biology
1 - BIOL 105 General Biology Lab. I
3 - GEOL 205 Mineralogy and Intro. Petrology
1 - GEOL 207 Mineral. and Intro. Petrology Lab.
1 - GEOL 291 Introduction to Research I
3 - Arts and Humanities (Non-Lit.) Requirement
4 - Foreign Language Requirement
16
Second Semester
3 - BIOL 104 General Biology II
1 - BIOL 106 General Biology Lab. II
1 - GEOL 292 Introduction to Research II
3 - GEOL 300 Environmental Geology
4 - Foreign Language Requirement
3 - Minor Requirement
15
Junior Year
First Semester
2 - GEOL 391 Research Methods I
3 - Foreign Language Requirement
3 - Geology Requirement
3 - Minor Requirement
3 - Social Science Requirement
3 - Technical Requirement
17
Second Semester
2 - GEOL 392 Research Methods II
3 - Foreign Language Requirement
3 - Geology Requirement
3 - Minor Requirement
3 - Elective
17
Senior Year
First Semester
3 - GEOL 491 Research Synthesis I
3 - Arts and Humanities (Literature) Requirement
3 - Minor Requirement
1 - Elective
12
Second Semester
3 - GEOL 492 Research Synthesis II
3 - Minor Requirement
3 - Technical Requirement
6 - Elective
15
122 Total Semester Hours
*See General Education Requirements. 
**Spanish is recommended. Two years (through 202) in the same foreign language are required.
†See advisor.
‡Any 300- or 400-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 200 Economic Concepts1 or
3 - ECON 211 Principles of Microeconomics1
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities (Non-Lit.) Requirement2
3 - Foreign Language Requirement8
16

Second Semester
4 - MTHSC 108 Calculus of One Variable II
3 - MTHSC 119 Intro. to Discrete Methods or
3 - PHYS 122 Physics with Calculus I
3 - Computer Science Requirement4
3 - Social Science Requirement2
16

Sophomore Year
First Semester
4 - MTHSC 206 Calculus of Several Variables
1 - MTHSC 230 Intro. to Mathematical Sciences
3 - MTHSC 311 Linear Algebra
3 - MTHSC 360 Intermediate Math. Computing
4 - Natural Science Requirement4
15

Second Semester
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - MTHSC 302 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 314 Technical Writing
3 - MTHSC 400 Theory of Probability
3 - MTHSC 440 Linear Programming
3 - MTHSC 453 Advanced Calculus I
3 - Science Requirement6
15

Second Semester
3 - MTHSC 412 Introduction to Modern Algebra
3 - MTHSC 454 Advanced Calculus II
3 - Emphasis Area Requirement5
3 - Science Requirement6
3 - Elective
15

Senior Year
First Semester
3 - COMM 250 Public Speaking
3 - Capstone Experience9
6 - Emphasis Area Requirement5
3 - Science and Tech. in Society Requirement2
15

Second Semester
1 - MTHSC 492 Professional Development
3 - Capstone Experience9
3 - Emphasis Area Requirement5
3 - Mathematical Sciences Requirement8
3 - Elective
13

122 Total Semester Hours

ECON 200 or ECON 211 is recommended, but any other social science course that satisfies the Social Sciences General Education requirement may be taken. ECON 211 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 102 or above.

CP SC 101, 111, or 120

A twosemester sequence selected from BIOL 103/105 and 104/106; CH 101 and 102; PHYS 221/223 and 222/224; GEOL 101/103 and 102 or 112/114.

ECON 212 and 405; CP SC 102 and 212; CP SC 210 and 212; ECON 212 and FIN 311; or any two natural science courses from General Education Natural Science Requirements (labs not required). Actuarial Science/Financial Mathematics ECON 212 and FIN 311; Operations Research Emphasis Area requires ECON 212 and 405; Computer Science Emphasis Area requires CP SC 102 and 212, or 210 and 212.


May be satisfied by (1) completion of six credits of MTHSC 482 or H482; (2) completion of six credits of MTHSC 491 or an approved substitution; or (3) completion of three credits of MTHSC 450 and three credits of an additional course approved by the advisor. Students in Actuarial Science/Financial Mathematics Emphasis Area must take MTHSC 407 and 441.

Any 400-level MTHSC course approved by advisor or EX ST 402.

Notes:
1. For graduation, a candidate for the BS degree in Mathematical Sciences will be required to have a 2.0 or higher cumulative grade point ratio in all required MTHSC courses.
2. A grade of C or better must be earned in all prerequisite courses before enrolling in the next MTHSC course.
3. Students who change majors to Mathematical Sciences must have achieved the Minimum Cumulative Grade Point Ratio (MCGPR) 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 MTHSC courses taken.

EMPHASIS AREAS

Abstract Mathematics1
6 - Abstract Mathematics Requirement2
6 - Mathematical Sciences Requirement1
12

Actuarial Science/Financial Mathematics4
3 - ACCT 201 Financial Accounting Concepts
1 - ACCT 204 Accounting Procedures
3 - FIN 312 Financial Management II
3 - MTHSC 403 Intro. to Statistical Theory
3 - MTHSC 431 Theory of Interest
13

Applied and Computational Mathematics
3 - MTHSC 434 Advanced Engineering Math.
3 - MTHSC 460 Intro. to Numerical Analysis I
6 - Applications Area1
12

Computer Science
3 - CP SC 215 Software Development Foundations
9 - Computer Science 300-Level Requirement5
12

Operations Research/Management Science
3 - IE 384 Engineering Economic Analysis or
4 - IE 482 Systems Modeling
3 - MGT 402 Operations Planning and Control
3 - MTHSC 407 Regress. and TimeSer. Analysis
3 - MTHSC 441 Intro. to Stochastic Models
12-13

Statistics
3 - MTHSC 403 Intro. to Statistical Theory
3 - MTHSC 405 Statistical Theory and Meth. II
3 - MTHSC 406 Sampling Theory and Methods
3 - MTHSC 407 Regress. and TimeSer. Analysis
12

1See advisor.
2MTHSC 410, 419, or 435
3Any 400-level MTHSC course
4Students are required to take MTHSC 407 and 441 as their capstone experience. Students who want to take the Society of Actuaries “P” and “FM” exams are also advised to take MTHSC 430 and 432.
5Any 300–400-level CP SC course

BIOLOGY CONCENTRATION

Freshman Year
First Semester
5 - BIOL 110 Principles of Biology I
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Foreign Language Requirement2
15

Second Semester
5 - BIOL 111 Principles of Biology II
4 - MTHSC 108 Calculus of One Variable II
3 - MTHSC 119 Intro. to Discrete Methods or
3 - Computer Science Requirement2
15

Sophomore Year
First Semester
4 - CH 101 General Chemistry
5 - ECON 200 Economic Concepts1 or
3 - ECON 211 Principles of Microeconomics1
4 - MTHSC 206 Calculus of Several Variables
1 - MTHSC 230 Intro. to Mathematical Sciences
3 - PHYS 207 General Physics I
1 - PHYS 209 General Physics I Lab.
16

Second Semester
4 - CH 102 General Chemistry
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - MTHSC 311 Linear Algebra
3 - PHYS 208 General Physics II
1 - PHYS 210 General Physics II Lab.
15
Junior Year
First Semester
3 - CH 223 Organic Chemistry
1 - CH 227 Organic Chemistry Lab.
1 - ENGL 314 Technical Writing
3 - MTHSC 360 Intermediate Math. Computing
3 - MTHSC 440 Linear Programming
3 - Arts and Humanities (Literature) Requirement
16

Second Semester
3 - CH 224 Organic Chemistry
1 - CH 228 Organic Chemistry Lab.
3 - COMM 250 Public Speaking
3 - MTHSC 302 Statistics for Science and Engr.
3 - Arts and Humanities (Non-Lit.) Requirement
3 - Math Science Requirement
16

Senior Year
First Semester
3 - MTHSC 400 Theory of Probability
3 - MTHSC 453 Advanced Calculus I or
3 - MTHSC 463 Mathematical Analysis I
3 - Animal or Plant Diversity Requirement
3 - Capstone Experience
3 - Social Science Requirement
15

Second Semester
3 - MTHSC 412 Introduction to Modern Algebra
3 - MTHSC 454 Advanced Calculus II
1 - MTHSC 492 Professional Development
3 - Biological Sciences Requirement
3 - Capstone Experience
13

121 Total Semester Hours

MATHEMATICAL SCIENCES
Bachelor of Arts
Freshman Year
First Semester
3 - ECON 200 Economic Concepts
3 - ECON 211 Principles of Microeconomics
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Foreign Language Requirement
1 - Elective
14
Second Semester
4 - MTHSC 108 Calculus of One Variable II
3 - MTHSC 119 Intro. to Discrete Methods or
3 - Computer Science Requirement
3 - Foreign Language Requirement
3 - Social Science Requirement
16

Sophomore Year
First Semester
4 - MTHSC 206 Calculus of Several Variables
1 - MTHSC 250 Intro. to Mathematical Sciences
3 - MTHSC 360 Intermediate Math. Computing or
3 - EDSEC 437 Technology in Sec. Math.
3 - Arts and Humanities (Literature) Requirement
3 - Cross-Cultural Awareness Requirement
14

Second Semester
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - MTHSC 302 Statistics for Science and Engr.
3 - MTHSC 311 Linear Algebra
3 - Arts and Humanities (Non-Lit.) Requirement
3 - Minor Requirement or
3 - Second Major Requirement
16

Junior Year
First Semester
3 - ENGL 314 Technical Writing
3 - MTHSC 412 Introduction to Modern Algebra
3 - Math Science Requirement
4 - Natural Science Requirement
3 - Elective
16

Second Semester
3 - COMM 250 Public Speaking
3 - Math Science Requirement
3 - Minor Requirement or
3 - Second Major Requirement
4 - Natural Science Requirement
3 - Elective
16

Senior Year
First Semester
3 - MTHSC 453 Advanced Calculus I
3 - Arts and Humanities Requirement or
3 - Education Requirement
3 - Capstone Experience
3 - Minor Requirement or
3 - Second Major Requirement
3 - Science and Tech. in Society Requirement
15

Second Semester
1 - MTHSC 492 Professional Development
3 - Capstone Experience
3 - Math Science Requirement
6 - Minor Requirement or
6 - Second Major Requirement
2 - Elective
15

122 Total Semester Hours

PHYSICS
Bachelor of Science
Physics, the most fundamental of the natural sciences, forms the basis of study upon which the other branches of science are founded. Physics is concerned with the fundamental behavior of matter and energy. Classical physics encompasses the fields of mechanics, heat and thermodynamics, electricity and magnetism, acoustics and optics. Modern physics is concerned with the study of atoms and molecules, atomic nuclei, elementary particles and the properties of liquids, crystalline solids, and other materials, as well as the areas of relativity, cosmology, and the large-scale structure of the universe.

The undergraduate Physics curricula provide students with a strong background in the classical areas of physics, as well as an introduction to the more important aspects of modern physics. The BS curriculum is directed toward preparing students...
for graduate study ultimately leading to the PhD degree or toward research and development work in industrial or governmental laboratories. It also provides a good background for graduate study or industrial work in many areas or engineering physics and applied science.

**Freshman Year**

**First Semester**
- 3 - ASTR 105 Physics of the Universe
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 1 - PHYS 101 Current Topics in Modern Physics
- 15

**Second Semester**
- 4 - CH 102 General Chemistry
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 1 - PHYS 124 Physics Lab. I
- 3 - Arts and Humanities (Non-Lit.) Requirement
- 15

**Sophomore Year**

**First Semester**
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II
- 1 - PHYS 223 Physics Lab. II
- 4 - Foreign Language Requirement
- 3 - Oral Communication Requirement
- 15

**Second Semester**
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 3 - PHYS 222 Physics with Calculus III
- 1 - PHYS 224 Physics Lab. III
- 4 - Foreign Language Requirement
- 3 - Social Science Requirement
- 15

**Junior Year**

**First Semester**
- 3 - PHYS 311 Intro. to Meth. of Theoretical Phys.
- 3 - PHYS 321 Mechanics I
- 3 - PHYS 325 Experimental Physics I
- 1 - PHYS 300 Introduction to Research
- 16

**Second Semester**
- 1 - PHYS 310 Introduction to Research
- 3 - PHYS 312 Methods of Theoretical Physics II
- 3 - PHYS 322 Mechanics II
- 1 - PHYS 356 Modern Physics Overview
- 3 - PHYS 441 Electromagnetics I
- 3 - Biophysics Requirement
- 4 - Foreign Language Requirement
- 16

**Senior Year**

**First Semester**
- 3 - PHYS 442 Electromagnetics II
- 3 - PHYS 453 Quantum Physics I
- 3 - Biophysics Requirement
- 3 - Physics Writing Requirement
- 3 - Science Requirement
- 15

**Second Semester**
- 3 - HIST 172 The West and the World I or
- 3 - HIST 173 The West and the World II
- 3 - PHYS 456 Quantum Physics II
- 3 - PHYS 465 Thermodynamics and Statistical Mechanics
- 3 - Arts and Humanities (Literature) Requirement
- 3 - Emphasis Area Requirement
- 15

**Second Semester**
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 3 - PHYS 222 Physics with Calculus III
- 1 - PHYS 224 Physics Lab. III
- 4 - Biophysics Requirement
- 3 - Social Science Requirement
- 15

**BIOPHYSICS CONCENTRATION**

The Biophysics Concentration offers an excellent preparation for medical school or graduate work in biological sciences. It includes the flexibility of selecting courses in chemistry, biological sciences, physics, and mathematics. This concentration also provides the necessary background for employment in industry, manufacturing, and instrumentation for clinical or molecular biology applications.

**Freshman Year**

**First Semester**
- 3 - ASTR 105 Physics of the Universe
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 1 - PHYS 101 Current Topics in Modern Physics
- 15

**Second Semester**
- 4 - CH 102 General Chemistry
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 1 - PHYS 124 Physics Lab. I
- 3 - Arts and Humanities (Non-Lit.) Requirement
- 15

**Sophomore Year**

**First Semester**
- 3 - PHYS 101 Current Topics in Modern Physics
- 3 - PHYS 122 Physics with Calculus I
- 1 - PHYS 124 Physics Lab. I
- 3 - Arts and Humanities (Non-Lit.) Requirement
- 15

**Second Semester**
- 3 - PHYS 101 Current Topics in Modern Physics
- 3 - PHYS 122 Physics with Calculus II
- 1 - PHYS 124 Physics Lab. II
- 3 - Oral Communication Requirement
- 16

**Junior Year**

**First Semester**
- 3 - PHYS 311 Intro. to Meth. of Theoretical Phys.
- 3 - PHYS 321 Mechanics I
- 3 - PHYS 325 Experimental Physics I
- 1 - PHYS 300 Introduction to Research
- 16

**Second Semester**
- 1 - PHYS 310 Introduction to Research
- 3 - PHYS 312 Methods of Theoretical Physics II
- 3 - PHYS 322 Mechanics II
- 1 - PHYS 356 Modern Physics Overview
- 3 - PHYS 441 Electromagnetics I
- 3 - Biophysics Requirement
- 4 - Foreign Language Requirement
- 16

**Senior Year**

**First Semester**
- 3 - PHYS 442 Electromagnetics II
- 3 - PHYS 453 Quantum Physics I
- 3 - Biophysics Requirement
- 3 - Physics Writing Requirement
- 3 - Science Requirement
- 15

**Second Semester**
- 3 - HIST 172 The West and the World I or
- 3 - HIST 173 The West and the World II
- 3 - PHYS 456 Quantum Physics II
- 3 - PHYS 465 Thermodynamics and Statistical Mechanics
- 3 - Arts and Humanities (Literature) Requirement
- 3 - Biophysics Requirement
- 15

**Second Semester**
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 3 - PHYS 222 Physics with Calculus III
- 1 - PHYS 224 Physics Lab. III
- 4 - Biophysics Requirement
- 3 - Social Science Requirement
- 15

**125 Total Semester Hours**

**See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.**

**Select from department-approved list of courses in biological sciences, chemistry, mathematical sciences, and physics. At least six credit hours must be in biological sciences.**

**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 300–400 level, are required. Note: Requirements for a minor in one of these areas might be satisfied with three additional credits at the 300–400 level.**

**ENGL 304, 312, 314, 315, 316, 345, 346, 348, M L 402, or THEA (ENGL) 347**

**Any 200–400 level science course**

**Select any ENGL course from General Education Arts and Humanities (Literature) Requirement.**

**1**See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.

**Select from department-approved list of courses in biological sciences, chemistry, mathematical sciences, and physics. At least six credit hours must be in biological sciences.**

**Two semesters (through 102) in the same modern foreign language are required.**

**Select any ENGL course from General Education Arts and Humanities (Literature) Requirement.**

**6**Select any ENGL course from General Education Arts and Humanities (Literature) Requirement.

**332 have been completed.**

**THEA (ENGL) 347**
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.

Double Major in Physics/Science Teaching—Physics
The Bachelor of Arts Degree in Physics and Science Teaching—Physics prepares students for teaching physics on the secondary school level and for graduate studies in physics. See pages 111-112 for the curriculum.

Freshman Year
First Semester
3 - ASTR 105 Physics of the Universe
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
1 - PHYS 101 Current Topics in Modern Physics
15

Second Semester
4 - CH 102 General Chemistry
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
1 - PHYS 124 Physics Lab. I
3 - Arts and Humanities (Non-Lit.) Requirement1
15

Sophomore Year
First Semester
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. II
4 - Foreign Language Requirement2
3 - Oral Communication Requirement1
15

Second Semester
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - PHYS 222 Physics with Calculus III
1 - PHYS 224 Physics Lab. III
4 - Foreign Language Requirement2
3 - Social Science Requirement1
15

Junior Year
First Semester
3 - PHYS 311 Intro. to Meth. of Theoretical Phys.
3 - PHYS 321 Mechanics I
3 - PHYS 325 Experimental Physics I
3 - Foreign Language Requirement2
3 - Minor Requirement3
15

Second Semester
1 - PHYS 300 Introduction to Research
3 - PHYS 312 Methods of Theoretical Physics II
3 - PHYS 322 Mechanics II
1 - PHYS 356 Modern Physics Overview
3 - PHYS 441 Electromagnetics I
3 - Foreign Language Requirement2
3 - Minor Requirement3
17

Senior Year
First Semester
3 - PHYS 455 Quantum Physics I
6 - Minor Requirement3
3 - Physics Writing Requirement4
3 - Physics Requirement5
15

Second Semester
3 - HIST 172 The West and the World I or
3 - HIST 173 The West and the World II
3 - Arts and Humanities (Literature) Requirement6
3 - Minor Requirement3
3 - Physics Requirement5
3 - Elective
3 - Minor Requirement3
17

122 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 202) in the same modern foreign language are required.
3See advisor.
4ENGL 304, 312, 314, 315, 316, 345, 346, 348 ML 402, or THEA (ENGL) 347.
5Any 300- or 400-level physics course
6Select any ENGL course from General Education Arts and Humanities (Literature) Requirement.
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
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 38-41 for details.