

# COLLEGE OF ENGINEERING AND SCIENCE

The College of Engineering and Science offers a broad range of rigorous and stimulating baccalaureate programs which provide unexcelled educational opportunities. The innovative combination of engineering and science disciplines which 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](http://www.clemson.edu/ces).

## Minors

Engineering and science students can complement their majors by selecting minor concentrations of study. Available minors include Bioengineering, Environmental Engineering, International Engineering and Science, one in each of the science majors, and in Textiles. (See page 104.)

## 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](http://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 Biosystems Engineering program is administered jointly with the College of Agriculture, Forestry, and Life Sciences. The new BS in Bioengineering degree program is designed to meet ABET requirements and will be submitted to ABET for accreditation review when eligible.

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

- apply knowledge of math, science, and engineering
- identify, formulate, and solve engineering problems
- design and conduct experiments and analyze data

- design systems or components to meet needs within realistic constraints
- function on multidisciplinary teams
- communicate effectively
- conduct themselves professionally and ethically
- understand engineering's global, economic, environmental, and societal context
- understand contemporary engineering issues
- apply modern engineering methods and tools
- appreciate the need for life-long 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<sup>1</sup>
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - General Education Requirement<sup>2</sup>
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### Second Semester

- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 2-3 - Departmental Freshman Engineering Req.<sup>3</sup>
- 3-4 - Departmental Science Requirement<sup>3</sup>
- 3 - General Education Requirement<sup>2</sup>
- 15-17

<sup>1</sup>CES 101 may be substituted.

<sup>2</sup>See Policy on General Education Requirements for Engineering Curricula below.

<sup>3</sup>See 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 - CES 102 Engineering Disciplines and Skills or
- 3 - CES 101 Engineering Disciplines and Skills with Recitation
- 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 curricula. Further, the program of study must include educational experiences addressing the intersection of science and technology with society and cross-cultural awareness.

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

## Electives for Engineering Curricula

Advisors must approve any course taken for elective credit in the Engineering curricula. Courses excluded for elective credit include PHYS 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: Biomaterials Concentration or Bioelectrical Concentration.

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

### Combined Bachelor's/Master's Plan

Bioengineering undergraduates may begin a Master of Science degree program while completing the Bachelor of Science degree and use a limited number of courses to satisfy the requirements of both the undergraduate and graduate degrees. Details are available from the Department of Bioengineering.

## BIOELECTRICAL CONCENTRATION

### Freshman Year

#### First Semester

- 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<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

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#### 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<sup>2</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

- 1 - Biology Requirement<sup>3</sup>

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### Sophomore Year

#### First Semester

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

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#### Second Semester

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

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### Junior Year

#### First Semester

- 4 - CH 201 Survey of Organic Chemistry<sup>2</sup>
- 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 Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

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#### 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 Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 3 - Bioengineering or E C E Technical Requirement<sup>3</sup>

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### Senior Year

#### First Semester

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

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### 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 Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 6 - Bioengineering or E C E Technical Requirement<sup>3</sup>

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128 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>Students planning to enter medical school should take CH 223/227 instead of CH 201 and take CH 224/228 as an additional course sequence. Students planning to enter medical school should also take physics laboratories as additional courses (PHYS 124 and PHYS 223).

<sup>3</sup>Select from department-approved list.

#### Notes:

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

## 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 Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

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#### Second Semester

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

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### Sophomore Year

#### First Semester

- 3 - BIO E 201 Intro. to Biomedical Engineering
- 3 - C M E 210 Introduction to Materials Science
- 4 - CH 201 Survey of Organic Chemistry<sup>2</sup>
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II<sup>2</sup>

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**Second Semester**

- 3 - BIO E 302 Biomaterials
- 1 - C M E 241 Metrics Lab.
- 2 - E C E 307 Basic Electrical Engineering
- 1 - E C E 309 Electrical Engineering Lab. I
- 3 - E M 201 Engineering Mechanics: Statics
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

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**Junior Year****First Semester**

- 3 - BIO E 320 Biomechanics
- 4 - BIOSC 315 Functional Human Anatomy
- 3 - C M E 319 Materials Processing I
- 3 - C M E 326 Thermodynamics of Materials
- 3 - C M E 327 Transport Phenomena

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**Second Semester**

- 3 - BIOCH 305 Essential Elements of Biochem.
- 3 - C M E 422 Mechanical Behavior of Materials
- 3 - MTHSC 302 Statistics for Science and Engr.
- 3 - Bioengineering Technical Requirement<sup>3</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

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**Senior Year****First Semester**

- 3 - BIO E 370 Bioinstrumentation and Bioimaging
- 3 - BIO E 401 Bioengineering Design Theory
- 3 - BIOSC 461 Cell Biology
- 2 - BIOSC 462 Cell Biology Lab.
- 3 - PFC 415 Intro. to Polymer Science and Engr.
- 3 - Bioengineering Technical Requirement<sup>3</sup>

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**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 Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>
- 3 - Bioengineering Technical Requirement<sup>3</sup>

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128 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>Students planning to enter medical school should take CH 223/227 instead of CH 201 and take CH 224/228 as an additional course sequence. Students planning to enter medical school should also take physics laboratories as additional courses (PHYS 124 and PHYS 223).

<sup>3</sup>Select from department-approved list.

*Note:* 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.

**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 86, 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 concentrations. The Applied Biotechnology Concentration 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. The Natural Resources and Environment Concentration 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 [www.clemson.edu/agbioeng/bio/home.htm](http://www.clemson.edu/agbioeng/bio/home.htm).

**Combined Bachelor's/Master's Program**

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

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

Students are encouraged to obtain the specific requirements for the dual degree from the academic departments involved as early as possible in their undergraduate program. See *Academic Regulations* in this catalog for enrollment guidelines and procedures.

**APPLIED BIOTECHNOLOGY CONCENTRATION****Freshman Year****First Semester**

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

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**Second Semester**

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

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**Sophomore Year****First Semester**

- 2 - B E 210 Intro. to Biosystems Engineering
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II
- 4 - Biology Requirement<sup>2</sup>
- 3 - Statics Requirement<sup>2</sup>

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**Second Semester**

- 2 - B E 212 Fundamentals of Biosystems Engr.
- 2 - E G 209 Intro. to Engr./Computer Graphics
- 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
- 2 - Dynamics Requirement<sup>2</sup>

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**Junior Year****First Semester**

- 3 - B E 312 Biol. Kinetics and Reactor Modeling
- 4 - C E 341 Introduction to Fluid Mechanics or
- 4 - CH E 230 Fluids/Heat Transfer
- 2 - E C E 307 Basic Electrical Engineering
- 3 - Mechanics of Materials Requirement<sup>2</sup>
- 4 - Organic Chemistry Requirement<sup>3</sup>

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**Second Semester**

- 3 - B E 314 Biosystems Engr. Mechanical Design or
- 3 - M E 306 Fundamentals of Machine Design
- 3 - B E 412 Heat and Mass Transport in B E
- 4 - B E 415 Instrumentation and Control for Biosystems Engineers
- 3 - B E (CH E) 428 Biochemical Engineering
- 4 - Biochemistry Requirement<sup>4</sup>

17

**Senior Year****First Semester**

- 3 - B E 414 Biosystems Engr. Unit Operations
- 3 - B E 438 Bioprocess Engineering Design
- 2 - B E 474 Biosystems Engr. Design/Project Mgt.
- 6 - Arts and Humanities Requirement<sup>1</sup> or
- 6 - Social Science Requirement<sup>1</sup>
- 3 - Life Science Requirement<sup>5</sup>

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**Second Semester**

- 3 - B E 435 Appl. in Biotechnology Engineering  
 2 - B E 475 Biosystems Engr. Capstone Design  
 3 - Arts and Humanities Requirement<sup>1</sup> or  
   3 - Social Science Requirement<sup>1</sup>  
 3 - Engineering Requirement<sup>2</sup>  
 2 - Elective  
 13

128 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>See advisor. Select from department-approved list.

<sup>3</sup>CH 223 and 227 (preferred) or CH 201

<sup>4</sup>BIOCH 301/302 or 305/306

<sup>5</sup>MICRO 413 or any approved 300-400-level course in BIOCH, BIOSC, GEN, or MICRO

**Notes:**

- Biosystems Engineering students are allowed to enroll in upper-level B E courses only when the following prerequisites have been completed with C or better: C E 206, 208, 341, CH E 220, 230, E M 201, 202, M E 201, 302, 310, MTHSC 206, 208, PHYS 221.
- Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Life Science and Engineering Requirements.
- To complete premedicine requirements, students must take BIOL 104/106 or 111, CH 224, 228, and PHYS 124, 223 as additional courses.

## NATURAL RESOURCES AND ENVIRONMENT CONCENTRATION

**Freshman Year****First Semester**

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

**Second Semester**

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

**Sophomore Year****First Semester**

- 2 - B E 210 Intro. to Biosystems Engineering  
 2 - B E 222 Geomeasurements  
 4 - MTHSC 206 Calculus of Several Variables  
 3 - PHYS 221 Physics with Calculus II  
 4 - Biology Requirement<sup>2</sup>  
 3 - Statics Requirement<sup>2</sup>  
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**Second Semester**

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

**Junior Year****First Semester**

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

**Second Semester**

- 3 - B E 314 Biosystems Engr. Mechanical Design or  
   3 - M E 306 Fundamentals of Machine Design  
 3 - B E 322 Small Watershed Hydrology and  
   Sedimentology  
 3 - B E 412 Heat and Mass Transport in B E  
 4 - B E 415 Instrumentation and Control for B E  
 3 - Structural Design Requirement<sup>2</sup>  
 16

**Senior Year****First Semester**

- 3 - B E 414 Biosystems Engr. Unit Operations  
 3 - B E 464 Non-Point Source Management in  
   Engineered Ecosystems  
 2 - B E 474 Biosystems Engr. Design/Project Mgt.  
 6 - Arts and Humanities Requirement<sup>1</sup> or  
   6 - Social Science Requirement<sup>1</sup>  
 3 - Engineering Requirement<sup>2</sup>  
 17

**Second Semester**

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

128 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>See advisor. Select from department-approved list.

**Notes:**

- Biosystems Engineering students are allowed to enroll in upper-level B E courses only when the following prerequisites have been completed with C or better: C E 206, 208, 341, CH E 220, 230, E M 201, 202, M E 201, 302, 310, MTHSC 206, 208, PHYS 221.
- Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Engineering Requirements.

## CERAMIC AND MATERIALS ENGINEERING

**Bachelor of Science**

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

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

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

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

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

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

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

**Freshman Year****First Semester**

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

**Second Semester**

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

**Sophomore Year****First Semester**

- 3 - C M E 210 Introduction to Materials Science
  - 4 - MTHSC 206 Calculus of Several Variables
  - 3 - PHYS 221 Physics with Calculus II
  - 6 - Arts and Humanities Requirement<sup>1</sup> or  
6 - Social Science Requirement<sup>1</sup>
- 16

**Second Semester**

- 1 - C M E 241 Metrics Lab.
  - 2 - E G 209 Intro. to Engr./Computer Graphics
  - 3 - E M 201 Engineering Mechanics: Statics
  - 3 - MS&E 324 Statistics for Materials Science and Engineering
  - 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 16

**Junior Year****First Semester**

- 3 - C M E 319 Materials Processing I
  - 3 - C M E 326 Thermodynamics of Materials
  - 3 - C M E 327 Transport Phenomena
  - 3 - COMM 250 Public Speaking
  - 3 - Technical Writing Requirement<sup>2</sup>
- 15

**Second Semester**

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

**Senior Year****First Semester**

- 3 - C M E 402 Solid State Materials
  - 3 - C M E 413 Noncrystalline Materials
  - 3 - C M E 432 Manufacturing Processes and Syst.
  - 1 - C M E 441 Manufacturing Lab.
  - 3 - PFC 415 Intro. to Polymer Science and Engr.
  - 3 - Research Requirement<sup>2</sup>
- 16

**Second Semester**

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

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>See advisor.

**CHEMICAL ENGINEERING****Bachelor of Science**

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

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

Chemical engineers are involved in the research, manufacture, 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.

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

**Freshman Year****First Semester**

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

**Second Semester**

- 4 - CH 102 General Chemistry
  - 3 - CH E 130 Chemical Engineering Tools
  - 4 - MTHSC 108 Calculus of One Variable II
  - 3 - PHYS 122 Physics with Calculus I
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 17

**Sophomore Year****First Semester**

- 3 - CH 223 Organic Chemistry
  - 4 - CH E 211 Intro. to Chemical Engineering
  - 4 - MTHSC 206 Calculus of Several Variables
  - 3 - PHYS 221 Physics with Calculus II
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 17

**Second Semester**

- 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
  - 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 15

**Junior Year****First Semester**

- 1 - CH 339 Physical Chemistry Lab.
  - 3 - CH E 307 Unit Operations Lab. I
  - 3 - CH E 319 Engineering Materials
  - 2 - E C E 307 Basic Electrical Engineering
  - 1 - E C E 309 Electrical Engineering Lab. I
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
  - 3 - Biochemistry Requirement<sup>2</sup>
- 16

**Second Semester**

- 3 - CH 332 Physical Chemistry
  - 1 - CH 340 Physical Chemistry Lab.
  - 3 - CH E 321 Chemical Engr. Thermodynamics II
  - 4 - CH E 330 Mass Transfer and Separation Proc.
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
  - 3 - Emphasis Area Requirement<sup>3</sup>
- 17

**Senior Year****First Semester**

- 3 - CH E 407 Unit Operations Lab. II
  - 3 - CH E 431 Chemical Process Design I
  - 1 - CH E 443 Chemical Engr. Senior Seminar I
  - 3 - CH E 450 Chemical Reaction Engineering
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
  - 3 - Emphasis Area Requirement<sup>3</sup>
- 16

**Second Semester**

- 3 - CH E 353 Process Dynamics and Control
  - 3 - CH E 433 Process Design II
  - 1 - CH E 444 Chemical Engr. Senior Seminar II
  - 3 - MICRO 413 Industrial Microbiology
  - 3 - Emphasis Area Requirement<sup>3</sup>
- 13

127 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>BIOCH 301, 305, or 423

<sup>3</sup>See advisor for details. Nine credit hours devoted to completion of an emphasis area or approved minor are required. Emphasis areas are Applied Engineering, Mathematics, and Science; Biomolecular Science and Engineering; Business Management; Environmental Engineering; Polymeric Materials; Energy Studies.

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

## BIOMOLECULAR ENGINEERING CONCENTRATION

### Freshman Year

#### First Semester

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

#### Second Semester

- 4 - CH 102 General Chemistry
  - 3 - CH E 130 Chemical Engineering Tools
  - 4 - MTHSC 108 Calculus of One Variable II
  - 3 - PHYS 122 Physics with Calculus I
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 17

### Sophomore Year

#### First Semester

- 3 - CH 223 Organic Chemistry
  - 4 - CH E 211 Intro. to Chemical Engineering
  - 4 - MTHSC 206 Calculus of Several Variables
  - 3 - PHYS 221 Physics with Calculus II
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 17

#### Second Semester

- 3 - BIOCH 301 Molecular Biochemistry
  - 1 - BIOCH 302 Molecular Biochemistry Lab.
  - 3 - CH 224 Organic Chemistry
  - 1 - CH 229 Organic Chemistry Lab.
  - 3 - CH E 220 Chemical Engr. Thermodynamics I
  - 4 - CH E 230 Fluids/Heat Transfer
- 15

### Junior Year

#### First Semester

- 3 - BIOL 103 General Biology I
  - 1 - BIOL 105 General Biology Lab. I
  - 3 - CH E 307 Unit Operations Lab. I
  - 3 - CH E 319 Engineering Materials
  - 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 17

#### Second Semester

- 3 - BIO E 302 Biomaterials
  - 3 - BMOLE 425 Biomolecular Engineering
  - 3 - CH E 321 Chemical Engr. Thermodynamics II
  - 4 - CH E 330 Mass Transfer and Separation Proc.
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 16

### Senior Year

#### First Semester

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

#### Second Semester

- 3 - CH E 353 Process Dynamics and Control
  - 3 - CH E 433 Process Design II
  - 1 - CH E 444 Chemical Engr. Senior Seminar II
  - 3 - MICRO 413 Industrial Microbiology
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
  - 3 - Engineering Requirement<sup>2</sup>
- 16

130 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>B E (CH E) 428, BMOLE 423, 426, or 427

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

## 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 86 for the College of Engineering and Science. The complete objectives of the program can be found at [www.ce.clemson.edu](http://www.ce.clemson.edu).

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

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

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

### Freshman Year

#### First Semester

- 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<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 16

#### Second Semester

- 2 - ENGR 130 Engineering Fundamentals
  - 3 - GEOL 101 Physical Geology
  - 1 - GEOL 103 Physical Geology Lab.
  - 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 Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 17

### Sophomore Year

#### First Semester

- 2 - E G 210 Intro. to Engr./Computer Graphics
  - 3 - E M 201 Engineering Mechanics: Statics
  - 4 - MTHSC 206 Calculus of Several Variables
  - 3 - PHYS 221 Physics with Calculus II
  - 1 - PHYS 223 Physics Lab. II
  - 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 16

#### Second Semester

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

### Junior Year

#### First Semester

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

#### Second Semester

- 3 - C E 311 Transportation Engineering Planning and Design
  - 4 - C E 321 Geotechnical Engineering
  - 3 - C E 342 Applied Hydraulics and Hydrology
  - 1 - C E 353 Professional Seminar
  - 3 - EE&S 401 Environmental Engineering
  - 3 - Design Technical Requirement<sup>2</sup>
- 17

## Senior Year

### First Semester

- 3 - ENGL 314 Technical Writing
  - 3 - Design Technical Requirement<sup>2</sup>
  - 6 - Technical Requirement<sup>3</sup>
  - 3 - Technical Requirement Restricted<sup>3</sup>
- 
- 15

### Second Semester

- 3 - C E 459 Capstone Design Project
  - 3 - Arts and Humanities Requirement<sup>1</sup> *or*  
3 - Social Science Requirement<sup>1</sup>
  - 3 - Arts and Humanities (Literature) Requirement<sup>1</sup>
  - 3 - Technical Requirement<sup>3</sup>
  - 3 - Elective
- 
- 15

128 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>See advisor for approved list.

<sup>3</sup>See advisor for approved list. Technical Requirements and electives may be used to complete an emphasis area in one of the following fields: Applied Fluid Mechanics, Construction, Environmental Engineering, Geotechnical/Geoenvironmental Engineering, Structural Engineering, or Transportation Engineering.

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

## COMPUTER ENGINEERING

### Bachelor of Science

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

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

Information on the program and its objectives is available at [www.ece.clemson.edu/ece/index.shtml](http://www.ece.clemson.edu/ece/index.shtml).

### 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<sup>1</sup> *or*  
3 - Social Science Requirement<sup>1</sup>
- 
- 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
  - 6 - Arts and Humanities Requirement<sup>1</sup> *or*  
6 - Social Science Requirement<sup>1</sup>
- 
- 16

## Sophomore Year

### First Semester

- 3 - CP SC 111 Elementary Computer Programming in C/C++
  - 3 - E C E 201 Logic and Computing Devices
  - 3 - E C E 202 Electric Circuits I
  - 1 - E C E 211 Electrical Engineering Lab. I
  - 4 - MTHSC 206 Calculus of Several Variables
  - 3 - PHYS 221 Physics with Calculus II
- 
- 17

### Second Semester

- 1 - E C E 212 Electrical Engineering Lab. II
  - 3 - E C E 222 Systems Programming Concepts for Computer Engineering
  - 3 - E C E 262 Electric Circuits II
  - 4 - E C E 272 Computer Organization
  - 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 
- 15

## Junior Year

### First Semester

- 3 - E C E 223 Computer Systems Engineering
  - 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
  - 4 - E C E 371 Microcomputer Interfacing
  - 3 - MTHSC 311 Linear Algebra
- 
- 17

### Second Semester

- 3 - E C E 317 Random Signal Analysis
  - 3 - E C E 327 Digital Computer Design
  - 3 - E C E 329 Computer Systems Structures
  - 3 - E C E 352 Programming Systems
  - 3 - MTHSC 419 Discrete Math. Structures I
- 
- 15

## Senior Year

### First Semester

- 3 - COMM 150 Intro. to Human Comm. *or*  
3 - COMM 250 Public Speaking
  - 3 - ENGL 314 Technical Writing
  - 9 - Computer Engineering Technical Requirement<sup>2</sup>
- 
- 15

### Second Semester

- 3 - E C E 453 Software Practicum
  - 3 - Arts and Humanities (Literature) Requirement<sup>3</sup>
  - 3 - Arts and Humanities Requirement<sup>1</sup> *or*  
3 - Social Science Requirement<sup>1</sup>
  - 6 - Computer Engr. Depth Tech. Requirement<sup>2</sup>
- 
- 15

126 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>Select from department-approved list.

<sup>3</sup>See General Education Requirements.

#### Notes:

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

## 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.ece.clemson.edu/ece/index.shtml](http://www.ece.clemson.edu/ece/index.shtml).

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

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

### Freshman Year

#### First Semester

- 2 - 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<sup>1</sup> *or*  
3 - Social Science Requirement<sup>1</sup>
- 
- 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<sup>1</sup> *or*  
3 - Social Science Requirement<sup>1</sup>
- 
- 17

**Sophomore Year****First Semester**

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

17

**Second Semester**

- 1 - E C E 212 Electrical Engineering Lab. II
- 3 - E C E 262 Electric Circuits II
- 4 - E C E 272 Computer Organization
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 3 - Arts and Humanities Requirement<sup>1</sup> or 3 - Social Science Requirement<sup>1</sup> or 3 - Technical Requirement<sup>2,3</sup>

15

**Junior Year****First Semester**

- 1 - E C E 311 Electrical Engineering Lab. III
- 3 - E C E 320 Electronics I
- 3 - E C E 330 Signals, Systems, and Transforms
- 4 - E C E 371 Microcomputer Interfacing
- 3 - E C E 380 Electromagnetics
- 3 - Technical Requirement (Adv. Mathematics)<sup>4</sup>

17

**Second Semester**

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

16

**Senior Year****First Semester**

- 3 - COMM 150 Intro. to Human Comm. or 3 - COMM 250 Public Speaking
- 3 - E C E 409 Continuous and Discrete Syst. Des.
- 3 - E C E 427 Communications Systems
- 2 - E C E 495 Integrated Systems Design I
- 3 - Technical Requirement (E C E)<sup>3</sup>

14

**Second Semester**

- 2 - E C E 496 Integrated System Design II
- 6 - Arts and Humanities Requirement<sup>1</sup> or 6 - Social Science Requirement<sup>1</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or 3 - Social Science Requirement<sup>1</sup> or 3 - Technical Requirement (E C E)<sup>3</sup>
- 3 - Technical Requirement Depth (E C E)<sup>3</sup>

14

126 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>Students may enroll in E C E 222 for a common semester with Computer Engineering. Those not selecting this option should complete the Technical Requirement (E C E) in the senior year.

<sup>3</sup>Select from department-approved list.

<sup>4</sup>MTHSC 434, 435, 453, or 454

**Notes:**

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

**INDUSTRIAL ENGINEERING****Bachelor of Science**

Industrial engineers design, install, and improve the complex systems that provide goods and services vital to our society and economy. These systems place unique demands for breadth of preparation on industrial engineers. Baccalaureate degree graduates demonstrate the ability to design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy. Graduates will demonstrate the ability to apply the principles and techniques of industrial engineering analysis and design supported by a foundation in mathematical, physical, and social sciences, and economic, operational, and engineering analyses. Graduates will possess a breadth of knowledge that allows them to practice industrial engineering with an appropriate awareness of information issues in systems improvement. In addition, graduates are able to work and communicate effectively with colleagues at every level in 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](http://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<sup>1</sup> or 3 - Social Science Requirement<sup>1</sup>

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<sup>1</sup> or 3 - Social Science Requirement<sup>1</sup>
- 4 - Lab Science Requirement<sup>2</sup>

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<sup>3</sup>

16

**Second Semester**

- 3 - C M E 210 Introduction to Materials Science
- 2 - E G 208 Engineering Graphics with Computer Applications or 2 - E G 209 Introduction to Engineering/Computer Graphics
- 3 - E M 201 Engineering Mechanics: Statics<sup>4</sup>
- 3 - I E 210 Design and Analysis of Work Systems
- 3 - I E 384 Engineering Economic Analysis
- 3 - Arts and Humanities Requirement<sup>1</sup> or 3 - Social Science Requirement<sup>1</sup>

17

**Junior Year****First Semester**

- 2 - C E 208 Civil Engineering Dynamics<sup>4</sup>
- 3 - I E 360 Ind. Appl. of Probability and Statistics
- 1 - I E 368 Professional Practice in I E
- 3 - I E 440 Decision Support Systems in I E
- 3 - Arts and Humanities Requirement<sup>1</sup> or 3 - Social Science Requirement<sup>1</sup>
- 3 - Mathematics or Natural Science Req.<sup>2</sup>

15

**Second Semester**

- 3 - COMM 150 Intro. to Human Comm. or 3 - COMM 250 Public Speaking
- 2 - E C E 307 Basic Electrical Engineering
- 1 - E C E 309 Electrical Engineering Lab. I
- 3 - I E 361 Industrial Quality Control
- 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<sup>2</sup>  
 3 - Technical Requirement<sup>2</sup>  
 16

**Second Semester**

3 - I E 467 Systems Design II  
 3 - Arts and Humanities Requirement<sup>1</sup> or  
     3 - Social Science Requirement<sup>1</sup>  
 3 - Management Requirement<sup>2</sup>  
 3 - Technical Requirement<sup>2</sup>  
 12

124 Total Semester Hours

<sup>1</sup>See policy on Humanities and Social Sciences for Engineering curricula.<sup>2</sup>Select from department-approved list. See advisor.<sup>3</sup>PHYS 124 may be substituted.<sup>4</sup>M E 201 may be substituted for E M 201 and C E 208; E M 202 may be substituted for C E 208.**MECHANICAL ENGINEERING****Bachelor of Science**

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

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

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

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

Additional information can be found at [www.ces.clemson.edu/me](http://www.ces.clemson.edu/me).

**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<sup>1</sup> or  
     3 - Social Science Requirement<sup>1</sup>  
 16

**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 Requirement<sup>1</sup> or  
     3 - Social Science Requirement<sup>1</sup>  
 16

**Sophomore Year****First Semester**

5 - M E 201 Statics and Dynamics for Mech. Engr.  
 2 - M E 222 Mechanical Engineering Lab. I  
 4 - MTHSC 206 Calculus of Several Variables  
 3 - PHYS 221 Physics with Calculus II  
 3-5 - Science Requirement<sup>2</sup>  
 17-19

**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  
 4 - MTHSC 208 Intro. to Ordinary Diff. Equations  
 3 - Numerical Analysis Requirement<sup>2</sup>  
 16

**Junior Year****First Semester**

3 - M E 302 Mechanics of Materials  
 3 - M E 303 Thermodynamics  
 3 - M E 305 Model. and Analysis of Dynamic Syst.  
 3 - M E 308 Fluid Mechanics  
 2 - M E 333 Mechanical Engineering Lab. II  
 3 - Arts and Humanities Requirement<sup>1</sup> or  
     3 - Social Science Requirement<sup>1</sup>  
 17

**Second Semester**

3 - M E 304 Heat Transfer  
 3 - M E 306 Fundamentals of Machine Design  
 3 - M E 312 Manufacturing Proc. and Their Appl.  
 3 - Departmental Requirement<sup>2</sup>  
 3 - Statistics Requirement<sup>2</sup>  
 15

**Senior Year****First Semester**

3 - M E 401 Mechanical Engineering Design  
 3 - M E 403 Control and Integration of Multi-Domain Dynamic Systems  
 2 - M E 444 Mechanical Engineering Lab. III  
 6 - Technical Requirement<sup>2</sup>  
 14

**Second Semester**

1 - M E 400 Senior Seminar  
 3 - M E 402 Internship in Engineering Design  
 6 - Arts and Humanities Requirement<sup>1</sup> or  
     6 - Social Science Requirement<sup>1</sup>  
 3 - Technical Requirement<sup>2</sup>  
 13

124–126 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.<sup>2</sup>See advisor. Select from department-approved list.**Notes:**

1. A student is allowed to enroll in any M E course only when all prerequisites, as defined by current official listings for that course, have been passed with a grade of C or higher.

2. No student may exceed three attempts to complete successfully M E 201, 202, or 203. Registration for a third attempt to complete one of these M E courses requires the approval of the undergraduate coordinator in the Department of Mechanical Engineering. A grade of W counts as an unsuccessful attempt at completing the course.

3. For students repeating an M E course, registration preference will be given to students in a degree-granting engineering major whose curriculum requires the course in question.

**SCIENCE PROGRAMS**

The College offers curricula leading to the Bachelor of Science in Chemistry, Computer Information Systems, Computer Science, Geology, Mathematical Sciences, Physics, and Polymer and Fiber Chemistry. The Bachelor of Arts is offered in Chemistry, Computer Science, Geology, Mathematical Sciences, and Physics.

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

## Bachelor of Science Curricula

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

## Bachelor of Arts Curricula

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

Students have a large degree of flexibility and responsibility in selecting a minor from those listed on page 104. 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<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

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<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

16

### Sophomore Year

#### First Semester

- 3 - CH 223 Organic Chemistry
- 1 - CH 227 Organic Chemistry Lab.
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II
- 1 - PHYS 223 Physics Lab. II
- 4 - Foreign Language Requirement<sup>2</sup>

16

#### Second Semester

- 3 - CH 205 Introduction to Inorganic Chemistry
- 3 - CH 224 Organic Chemistry
- 1 - CH 228 Organic Chemistry Lab.
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 3 - PHYS 222 Physics with Calculus III
- 1 - PHYS 224 Physics Lab. III

15

### Junior Year

#### First Semester

- 3 - BIOCH 301 Molecular Biochemistry *or*  
3 - BIOCH 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<sup>1</sup>
- 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<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 3 - Chemistry Requirement<sup>3</sup>

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#### Second Semester

- 3 - CH 444 Research Problems
- 3 - CH 450 Chemistry Capstone
- 1 - CH 452 Chemistry Communication II
- 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 3 - Chemistry Requirement<sup>3</sup>
- 3 - Elective

16

122 Total Semester Hours

<sup>1</sup>See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>One semester (through 102) in any modern foreign language is required.

<sup>3</sup>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<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

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<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

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<sup>2</sup>

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<sup>1</sup> or  
6 - Social Science Requirement<sup>1</sup>
- 4 - Foreign Language Requirement<sup>2</sup>

17

#### Junior Year

##### First Semester

- 3 - CH 313 Quantitative Analysis
- 1 - CH 317 Quantitative Analysis Lab.
- 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 3 - Arts and Humanities (Literature) Requirement<sup>1</sup>
- 3 - Foreign Language Requirement<sup>2</sup>
- 3 - Minor Requirement

16

##### Second Semester

- 3 - CH 331 Physical Chemistry
- 3 - ENGL 314 Technical Writing
- 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>
- 3 - Foreign Language Requirement<sup>2</sup>
- 3 - Minor Requirement

15

**Senior Year****First Semester**

3 - CH 332 Physical Chemistry  
 3 - Chemistry Requirement<sup>3</sup>  
 3 - Minor Requirement  
 6 - Elective  
 15

**Second Semester**

3 - CH 450 Chemistry Capstone  
 1 - CH 452 Chemistry Communication II  
 3 - Chemistry Requirement<sup>3</sup>  
 6 - Minor Requirement  
 13  
 122 Total Semester Hours

<sup>1</sup>See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>Four semesters (through 202) of the same modern foreign language are required.

<sup>3</sup>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](http://www.cs.clemson.edu).

**Freshman Year****First Semester**

4 - CP SC 101 Computer Science I  
 3 - ENGL 103 Accelerated Composition  
 3 - MTHSC 102 Intro. to Mathemat. Analysis<sup>1</sup> and  
 1 - Elective<sup>1</sup> or  
 4 - MTHSC 106 Calculus of One Variable I<sup>1</sup>  
 4 - Natural Science Requirement<sup>2</sup>  
 15

**Second Semester**

4 - CP SC 102 Computer Science II  
 3 - MTHSC 207 Multivariable Calculus<sup>1</sup> and  
 1 - Elective<sup>1</sup> or  
 4 - MTHSC 108 Calculus of One Variable II<sup>1</sup>  
 3 - Arts and Humanities (Non-Lit.) Requirement<sup>3</sup>  
 3 - Natural Science Requirement<sup>2</sup>  
 3 - Social Science Requirement<sup>3</sup>  
 17

**Sophomore Year****First Semester**

4 - CP SC 212 Algorithms and Data Structures  
 3 - MTHSC 119 Introduction to Discrete Methods  
 3 - Arts and Humanities (Literature) Requirement<sup>3</sup>  
 3 - Oral Communication Requirement<sup>3</sup>  
 3 - Social Science Requirement<sup>3</sup>  
 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<sup>4</sup>  
 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<sup>5</sup>  
 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<sup>6</sup>  
 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<sup>7</sup>  
 3 - Computer Science Requirement<sup>6</sup>  
 15

**Second Semester**

3 - MGT 312 Decision Models for Management  
 3 - MKT 301 Principles of Marketing  
 3 - Business Requirement<sup>7</sup>  
 3 - Computer Science Requirement<sup>6</sup>  
 3 - Information Systems Requirement<sup>8</sup>  
 15

122 Total Semester Hours

<sup>1</sup>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.

<sup>2</sup>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.

<sup>3</sup>See General Education Requirements.

<sup>4</sup>MTHSC 301, 302, or 309.

<sup>5</sup>Select from School-approved list.

<sup>6</sup>Select from 300-level or higher CP SC courses. No more than six credits of CP SC 481 may be used.

<sup>7</sup>Select from MGT 390, 400, FIN 306.

<sup>8</sup>Select from MGT 452, 454, 455, 456, or 400-level CP SC courses. CP SC 481 may not be used.

**Notes:**

- For graduation, a candidate for the BS degree in Computer Information Systems must have earned a grade of C or better in each CP SC course applied to the degree.
- 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 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](http://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 106 Calculus of One Variable I  
 4 - Natural Science Requirement<sup>1</sup>  
 15

**Second Semester**

4 - CP SC 102 Computer Science II  
 4 - MTHSC 108 Calculus of One Variable II  
 3 - Arts and Humanities (Non-Lit.) Requirement<sup>2</sup>  
 4 - Natural Science Requirement<sup>1</sup>  
 15

**Sophomore Year****First Semester**

4 - CP SC 212 Algorithms and Data Structures  
 3 - MTHSC 119 Introduction to Discrete Methods  
 3 - Arts and Humanities (Literature) Requirement<sup>2</sup>  
 3 - Natural Science Requirement<sup>1</sup>  
 3 - Oral Communication Requirement<sup>2</sup>  
 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 - Natural Science Requirement<sup>1</sup>
  - 3 - Probability and Statistics Requirement<sup>3</sup>
  - 2 - Elective
- 
- 16

**Junior Year****First 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<sup>2</sup>
- 
- 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<sup>4</sup> or  
3 - Social Science Requirement<sup>4</sup>
  - 3 - Social Science Requirement<sup>2</sup>
- 
- 15

**Senior Year****First Semester**

- 3 - CP SC 352 Programming Languages
  - 6 - Computer Science Requirement<sup>5</sup>
  - 3 - Writing Requirement<sup>6</sup>
  - 3 - Elective
- 
- 15

**Second Semester**

- 3 - CP SC 491 Seminar in Professional Issues II
  - 3 - Arts and Humanities Requirement<sup>4</sup> or  
3 - Social Science Requirement<sup>4</sup>
  - 6 - Computer Science Requirement<sup>5</sup>
  - 3 - Elective
- 
- 15

122 Total Semester Hours

<sup>1</sup>Two-semester sequence in the same physical or biological science, 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.

<sup>2</sup>See General Education Requirements.

<sup>3</sup>MTHSC 301, 302 or 309.

<sup>4</sup>Select from 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.

<sup>5</sup>Select from 300-level or higher CP SC courses. No more than six credits of CP SC 481 may be applied to this requirement. Up to three credits of approved 300-level or higher MTHSC or E C E courses may be substituted.

<sup>6</sup>Select 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](http://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<sup>1</sup> and  
1 - Elective<sup>1</sup> or  
4 - MTHSC 106 Calculus of One Variable I<sup>1</sup>
  - 4 - Foreign Language Requirement<sup>2</sup>
- 
- 15

**Second Semester**

- 4 - CP SC 102 Computer Science II
  - 3 - MTHSC 207 Multivariable Calculus<sup>1</sup> and  
1 - Elective<sup>1</sup> or  
4 - MTHSC 108 Calculus of One Variable II<sup>1</sup>
  - 3 - Arts and Humanities (Non-Lit.) Req.<sup>3</sup>
  - 4 - Foreign Language Requirement<sup>2</sup>
- 
- 15

**Sophomore Year****First Semester**

- 4 - CP SC 212 Algorithms and Data Structures
  - 3 - MTHSC 119 Introduction to Discrete Methods
  - 3 - Arts and Humanities (Literature) Requirement<sup>3</sup>
  - 3 - Foreign Language Requirement<sup>2</sup>
  - 3 - Oral Communication Requirement<sup>3</sup>
- 
- 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<sup>2</sup>
  - 4 - Natural Science Requirement<sup>4</sup>
- 
- 15

**Junior Year****First Semester**

- 6 - Computer Science Requirement<sup>5</sup>
  - 3 - Mathematical Sciences Requirement<sup>6</sup>
  - 3 - Minor Requirement
  - 3 - Natural Science Requirement<sup>4</sup>
- 
- 15

**Second Semester**

- 3 - Computer Science Requirement<sup>5</sup>
  - 6 - Minor Requirement
  - 3 - Social Science Requirement<sup>3</sup>
  - 3 - Writing Requirement<sup>7</sup>
- 
- 15

**Senior Year****First Semester**

- 6 - Computer Science Requirement<sup>5</sup>
  - 3 - Departmental Humanities Requirement<sup>8</sup>
  - 3 - Minor Requirement
  - 3 - Social Science Requirement<sup>3</sup>
- 
- 15

**Second Semester**

- 3 - CP SC 491 Seminar in Professional Issues II
  - 3 - Computer Science Requirement<sup>5</sup>
  - 3 - Fine Arts Requirement<sup>9</sup>
  - 3 - Minor Requirement
  - 3 - Elective
- 
- 15

121 Total Semester Hours

<sup>1</sup>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.

<sup>2</sup>Four semesters (through 202) in the same modern foreign language are required.

<sup>3</sup>See General Education Requirements.

<sup>4</sup>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.

<sup>5</sup>Select from CP SC courses numbered 300 or higher. No more than six credits of CP SC 481 may be applied to this requirement. Up to three credits of approved 300-level or higher MTHSC or E C E courses may be substituted.

<sup>6</sup>MTHSC 301, 302, or 311. MTHSC 311 is required for all graphics courses.

<sup>7</sup>Select from School-approved list.

<sup>8</sup>Select from courses in A A H, ANTH, ART, CHIN, DANCE, ENGL, FR, GER, HUM, ITAL, JAPN, MUSIC, P A, PHIL, REL, RUSS, SPAN, THEA.

<sup>9</sup>MUSIC 210 or any course in A A H, ART, or THEA

**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.

**GEOLOGY****Bachelor of Science**

Geology and biogeochemical environmental science involve the physics and chemistry of materials which 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 pro-

cesses. The Bachelor of Science degree can be earned in traditional geology or with a concentration in Hydrogeology or Environmental Science. All majors participate in an interdisciplinary problem-oriented group research sequence and capstone course.

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

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

## Freshman Year

### First Semester

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

15

### Second Semester

- 4 - CH 102 General Chemistry
- 4 - GEOL 102 Earth History
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - Arts and Humanities (Non-Lit.) Requirement<sup>1</sup>

15

## Sophomore Year

### First Semester

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

15

### Second Semester

- 4 - CSENV 202 Soils
- 4 - GEOL 212 Geoanalysis II<sup>2</sup>
- 1 - GEOL 292 Introduction to Research II
- 3 - PHYS 122 Physics with Calculus I
- 3 - Social Science Requirement<sup>1</sup>

15

## 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 391 Research Methods I
- 3 - Arts and Humanities (Literature) Requirement<sup>1</sup>

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### Second Semester

- 3 - GEOL 300 Environmental Geology
- 4 - GEOL 313 Sedimentology and Stratigraphy
- 1 - GEOL 392 Research Methods II
- 3 - Geology Requirement<sup>3</sup>
- 3 - Social Science Requirement<sup>1</sup>

2 - Elective

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## Summer

- 6 - Summer Geology Field Course<sup>4</sup>

## Senior Year

### First Semester

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

13

### Second Semester

- 4 - GEOL 409 Subsurface Methods
- 4 - GEOL 492 Research Synthesis II
- 3 - Geology Requirement<sup>3</sup>
- 1 - Elective

12

121 Total Semester Hours

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

<sup>2</sup>MTHSC 206 and 208 or 301 or EX ST 301 may be substituted.

<sup>3</sup>Select from department-approved list.

<sup>4</sup>See advisor.

## ENVIRONMENTAL SCIENCE CONCENTRATION

### Freshman Year

#### First Semester

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

15

#### Second Semester

- 4 - CH 102 General Chemistry
- 4 - GEOL 102 Earth History
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - Arts and Humanities (Non-Lit.) Requirement<sup>1</sup>

15

## Sophomore Year

### First Semester

- 3 - BIOL 103 General Biology I
- 1 - BIOL 105 General Biology Lab. I
- 3 - GEOL 205 Mineralogy and Intro. Petrology
- 1 - GEOL 207 Mineral. and Intro. Petrology Lab.
- 4 - GEOL 211 Geoanalysis I<sup>2</sup>
- 1 - GEOL 291 Introduction to Research I
- 3 - Arts and Humanities (Literature) Requirement<sup>1</sup>

16

### Second Semester

- 3 - BIOL 104 General Biology II
- 1 - BIOL 106 General Biology Lab. II
- 4 - GEOL 212 Geoanalysis II<sup>2</sup>
- 1 - GEOL 292 Introduction to Research II
- 3 - GEOL 300 Environmental Geology
- 3 - PHYS 122 Physics with Calculus I

15

## Junior Year

### First Semester

- 3 - EN SP 200 Intro. to Environmental Science
- 1 - GEOL 391 Research Methods I
- 9 - Environmental Science Requirement<sup>3</sup>
- 3 - Social Science Requirement<sup>1</sup>

16

### Second Semester

- 3 - GEOL 318 Introduction to Geochemistry
- 1 - GEOL 392 Research Methods II
- 9 - Environmental Science Requirement<sup>3</sup>
- 3 - Social Science Requirement<sup>1</sup>

16

## Summer

- 3 - Field Experience<sup>4</sup>

## Senior Year

### First Semester

- 3 - EN SP 400 Studies in Environmental Science
- 3 - GEOL 408 Geohydrology
- 4 - GEOL 491 Research Synthesis I
- 3 - Environmental Science Requirement<sup>3</sup>

13

### Second Semester

- 3 - CH 223 Organic Chemistry *or*
- 3 - CH 413 Chemistry of Aqueous Systems
- 4 - GEOL 492 Research Synthesis II
- 6 - Environmental Science Requirement<sup>3</sup>

13

122 Total Semester Hours

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

<sup>2</sup>MTHSC 206 and 208 or 301 or EX ST 301 may be substituted.

<sup>3</sup>Select from department-approved list. At least three credit hours must be from geology courses.

<sup>4</sup>Field course in geology, ecology, or related area. Must be at least three credits. Students desiring to become registered professional geologists should take a six-credit summer geology field course.

## HYDROGEOLOGY CONCENTRATION

### Freshman Year

#### First Semester

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

#### Second Semester

- 4 - CH 102 General Chemistry
  - 4 - GEOL 102 Earth History
  - 4 - MTHSC 108 Calculus of One Variable II
  - 3 - Arts and Humanities (Non-Lit.) Requirement<sup>1</sup>
- 
- 15

### Sophomore Year

#### First Semester

- 3 - GEOL 205 Mineralogy and Intro. Petrology
  - 1 - GEOL 207 Mineral. and Intro. Petrology Lab.
  - 4 - GEOL 211 Geoanalysis I<sup>2</sup>
  - 1 - GEOL 291 Introduction to Research I
  - 3 - Arts and Humanities (Literature) Requirement<sup>1</sup>
  - 3 - Technical Requirement<sup>3</sup>
- 
- 15

#### Second Semester

- 4 - GEOL 212 Geoanalysis II<sup>2</sup>
  - 1 - GEOL 292 Introduction to Research II
  - 3 - GEOL 300 Environmental Geology
  - 3 - PHYS 122 Physics with Calculus I
  - 1 - PHYS 124 Physics Lab. I
  - 3 - Social Science Requirement<sup>1</sup>
- 
- 15

### Junior Year

#### First Semester

- 4 - GEOL 302 Structural Geology
  - 1 - GEOL 391 Research Methods I
  - 3 - GEOL 408 Hydrogeology
  - 3 - PHYS 221 Physics with Calculus II
  - 3 - Geology Requirement<sup>4</sup>
- 
- 14

#### Second Semester

- 4 - GEOL 313 Sedimentology and Stratigraphy
  - 3 - GEOL 318 Introduction to Geochemistry
  - 1 - GEOL 392 Research Methods II
  - 3 - Social Science Requirement<sup>1</sup>
  - 3 - Technical Requirement<sup>3</sup>
- 
- 14

### Summer

- 6 - GEOL 475 Summer Geology Field Camp

### Senior Year

#### First Semester

- 3 - GEOL 421 GIS Applications in Geology
  - 4 - GEOL 491 Research Synthesis I
  - 3 - Geology Requirement<sup>4</sup>
  - 3 - Technical Requirement<sup>3</sup>
- 
- 13

### Second Semester

- 3 - EE&S 401 Environmental Engineering
  - 4 - GEOL 409 Subsurface Methods
  - 4 - GEOL 492 Research Synthesis II
  - 3 - Technical Requirement<sup>3</sup>
- 
- 14

121 Total Semester Hours

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

<sup>2</sup>MTHSC 206 and 208 or 301 or EX ST 301 may be substituted.

<sup>3</sup>Select from department-approved list.

<sup>4</sup>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<sup>1</sup>
- 
- 14

##### Second Semester

- 4 - CH 102 General Chemistry
  - 3 - GEOG 103 World Regional Geography
  - 4 - GEOL 102 Earth History
  - 3 - Mathematics Requirement<sup>1</sup>
  - 2 - 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<sup>2</sup>
  - 4 - Foreign Language Requirement<sup>3</sup>
- 
- 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<sup>3</sup>
  - 3 - Minor Requirement<sup>4</sup>
- 
- 15

#### Junior Year

##### First Semester

- 1 - GEOL 391 Research Methods I
  - 3 - Foreign Language Requirement<sup>3</sup>
  - 3 - Geology Requirement<sup>2</sup>
  - 3 - Minor Requirement<sup>4</sup>
  - 3 - Social Science Requirement<sup>2</sup>
  - 3 - Technical Requirement<sup>6</sup>
- 
- 16

### Second Semester

- 1 - GEOL 392 Research Methods II
  - 3 - Foreign Language Requirement<sup>3</sup>
  - 3 - Geology Requirement<sup>2</sup>
  - 3 - Minor Requirement<sup>4</sup>
  - 6 - Elective
- 
- 16

### Senior Year

#### First Semester

- 4 - GEOL 491 Research Synthesis I
  - 3 - Arts and Humanities (Literature) Requirement<sup>2</sup>
  - 3 - Minor Requirement<sup>4</sup>
  - 3 - Elective
- 
- 13

#### Second Semester

- 4 - GEOL 492 Research Synthesis II
  - 3 - Minor Requirement<sup>4</sup>
  - 3 - Technical Requirement<sup>6</sup>
  - 6 - Elective
- 
- 16

122 Total Semester Hours

<sup>1</sup>MTHSC 106 and 108 are recommended; however, MTHSC 101 and 102 or MTHSC 102 and 203 may be substituted.

<sup>2</sup>See General Education Requirements.

<sup>3</sup>Spanish is recommended. Two years (through 202) in the same foreign language are required.

<sup>4</sup>See advisor.

<sup>5</sup>Any 300- or 400-level geology course

<sup>6</sup>Select from department-approved list.

## MATHEMATICAL SCIENCES

### Bachelor of Science

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

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

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

## Combined Bachelor's/Master's Plan

Under this plan, students may reduce the time necessary to earn both degrees by applying graduate credits to both undergraduate and graduate program requirements. Students are encouraged to obtain the specific requirements for pursuing the dual degree from the Department of Mathematical Sciences ([www.math.clemson.edu](http://www.math.clemson.edu)) as early as possible in their undergraduate program. Enrollment guidelines and procedures can be found under *Academic Regulations* in this catalog.

### Freshman Year

#### First Semester

3 - ECON 211 Principles of Microeconomics  
3 - ENGL 103 Accelerated Composition  
4 - MTHSC 106 Calculus of One Variable I  
3 - Arts and Humanities (Non-Lit.) Requirement<sup>1</sup>  
3 - Foreign Language Requirement<sup>2</sup>  
16

#### Second Semester

4 - MTHSC 108 Calculus of One Variable II  
3 - MTHSC 129 Prob. Solving in Discrete Math.  
3 - PHYS 122 Physics with Calculus I  
3 - Computer Science Requirement<sup>3</sup>  
3 - Social Science Requirement<sup>1</sup>  
16

### Sophomore Year

#### First Semester

4 - MTHSC 206 Calculus of Several Variables  
1 - MTHSC 250 Intro. to Mathematical Sciences  
3 - MTHSC 311 Linear Algebra  
3 - MTHSC 360 Intermediate Math. Computing  
4 - Natural Science Requirement<sup>4</sup>  
15

#### Second Semester

4 - MTHSC 208 Intro. to Ordinary Diff. Equations  
3 - MTHSC 302 Statistics for Science and Engr.  
3 - Arts and Humanities (Literature) Requirement<sup>1</sup>  
4 - Natural Science Requirement<sup>4</sup>  
3 - Elective  
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 Requirement<sup>5</sup>  
15

#### Second Semester

3 - MTHSC 412 Introduction to Modern Algebra  
3 - MTHSC 454 Advanced Calculus II  
3 - Emphasis Area Requirement<sup>6</sup>  
3 - Science Requirement<sup>5</sup>  
3 - Elective  
15

### Senior Year

#### First Semester

3 - COMM 250 Public Speaking  
3 - Capstone Experience<sup>7</sup>  
6 - Emphasis Area Requirement<sup>6</sup>  
3 - Science and Tech. in Society Requirement<sup>1</sup>  
15

#### Second Semester

1 - MTHSC 492 Professional Development  
3 - Capstone Experience<sup>7</sup>  
3 - Emphasis Area Requirement<sup>6</sup>  
3 - Mathematical Sciences Requirement<sup>8</sup>  
3 - Elective  
13

122 Total Semester Hours

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

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

<sup>3</sup>CPCSC 101, 111, or 120

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

<sup>5</sup>ECON 314 and 405; CP SC 102 and 212; CP SC 102 and 210; or any two natural science courses from General Education Natural Science Requirements (labs not required). Actuarial Science/Financial Mathematics and Operations Research Emphasis Areas require ECON 314 and 405. Computer Science Emphasis Area requires CP SC 102 and 212, or 210 and 212.

<sup>6</sup>Select from Abstract Mathematics, Actuarial Science/Financial Mathematics, Applied and Computational Mathematics, Computer Science, Operations Research/Management Science, or Statistics.

<sup>7</sup>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 441 and FIN 405.

<sup>8</sup>Any 400-level MTHSC course approved by advisor

#### 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.

### EMPHASIS AREAS

#### Abstract Mathematics<sup>1</sup>

6 - Abstract Mathematics Requirement<sup>2</sup>  
6 - Mathematical Sciences Requirement<sup>3</sup>  
12

#### Actuarial Science/Financial Mathematics<sup>4</sup>

3 - FIN 312 Financial Management II  
3 - MTHSC 403 Intro. to Statistical Theory  
3 - MTHSC 407 Regress. and Time-Ser. Analysis  
3 - MTHSC 431 Theory of Interest  
12

#### Applied and Computational Mathematics

3 - MTHSC 434 Advanced Engineering Math.  
3 - MTHSC 460 Intro. to Numerical Analysis I  
6 - Applications Area<sup>1</sup>  
12

### Computer Science

3 - CP SC 215 Software Development Foundations  
9 - Computer Science 300-Level Requirement<sup>5</sup>  
12

### Operations Research/Management Science

3 - I E 384 Engineering Economic Analysis or  
4 - I E 482 Systems Modeling  
3 - MGT 402 Operations Planning and Control  
3 - MTHSC 407 Regress. and Time-Ser. 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 Time-Ser. Analysis  
12

<sup>1</sup>See advisor.

<sup>2</sup>MTHSC 408, 410, 419, or 435

<sup>3</sup>Any 400-level MTHSC course

<sup>4</sup>See advisor. Students are advised to take ACCT 204, ECON 212, FIN 311, MTHSC 430, 432 as electives and FIN 405, MTHSC 441 as capstone experience.

<sup>5</sup>Any 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 Requirement<sup>1</sup>  
15

#### Second Semester

5 - BIOL 111 Principles of Biology II  
4 - MTHSC 108 Calculus of One Variable II  
3 - MTHSC 129 Prob. Solving in Discrete Math.  
3 - Computer Science Requirement<sup>2</sup>  
15

### Sophomore Year

#### First Semester

4 - CH 101 General Chemistry  
3 - ECON 200 Economic Concepts or  
3 - ECON 211 Principles of Microeconomics  
4 - MTHSC 206 Calculus of Several Variables  
1 - MTHSC 250 Intro. to Mathematical Sciences  
3 - PHYS 207 General Physics I  
1 - PHYS 209 General Physics I Lab.  
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.  
 3 - ENGL 314 Technical Writing  
 3 - MTHSC 360 Intermediate Math. Computing  
 3 - MTHSC 440 Linear Programming  
 3 - Arts and Humanities (Literature) Requirement<sup>3</sup>  
 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<sup>3</sup>  
 3 - Math Science Requirement<sup>4</sup>  
 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<sup>5</sup>  
 3 - Capstone Experience<sup>6</sup>  
 3 - Social Science Requirement<sup>3</sup>  
 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<sup>7</sup>  
 3 - Capstone Experience<sup>6</sup>  
 13

121 Total Semester Hours

<sup>1</sup>Three credits in any foreign language, including American Sign Language, numbered 102 or above<sup>2</sup>CP SC 101, 111, or 120<sup>3</sup>See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.<sup>4</sup>Any 400-level MTHSC course approved by advisor<sup>5</sup>BIOC 302, 303, 304, or 305<sup>6</sup>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 advisor.<sup>7</sup>BIOCH 301, GEN 302/303, MICRO 305, or any 300-400-level BIOC course**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.

**MATHEMATICAL SCIENCES****Bachelor of Arts****Freshman Year****First Semester**

3 - ECON 200 Economic Concepts *or*  
     3 - ECON 211 Principles of Microeconomics  
 3 - ENGL 103 Accelerated Composition  
 4 - MTHSC 106 Calculus of One Variable I  
 3 - Foreign Language Requirement<sup>1</sup>  
 1 - Elective  
 14

**Second Semester**

4 - MTHSC 108 Calculus of One Variable II  
 3 - MTHSC 129 Prob. Solving in Discrete Math.  
 3 - Computer Science Requirement<sup>2</sup>  
 3 - Foreign Language Requirement<sup>1</sup>  
 3 - Social Science Requirement<sup>3</sup>  
 16

**Sophomore Year****First Semester**

4 - MTHSC 206 Calculus of Several Variables  
 1 - MTHSC 250 Intro. to Mathematical Sciences  
 3 - MTHSC 360 Intermed. Math. Computing *or*  
     3 - EDSEC 437 Technology in Sec. Math.  
 3 - Arts and Humanities (Literature) Requirement<sup>3</sup>  
 3 - Elective  
 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<sup>3</sup>  
 3 - Minor Requirement<sup>4</sup> *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<sup>5</sup>  
 4 - Natural Science Requirement<sup>3</sup>  
 3 - Elective  
 16

**Second Semester**

3 - COMM 250 Public Speaking  
 3 - Math Science Requirement<sup>5</sup>  
 3 - Minor Requirement<sup>4</sup> *or*  
     3 - Second Major Requirement  
 4 - Natural Science Requirement<sup>3</sup>  
 3 - Elective  
 16

**Senior Year****First Semester**

3 - MTHSC 453 Advanced Calculus I  
 3 - Arts and Humanities Requirement<sup>3</sup> *or*  
     3 - Education Requirement<sup>6</sup>  
 3 - Capstone Experience<sup>7</sup>  
 3 - Minor Requirement<sup>4</sup> *or*  
     3 - Second Major Requirement  
 3 - Science and Tech. in Society Requirement<sup>3</sup>  
 15

**Second Semester**

1 - MTHSC 492 Professional Development  
 3 - Capstone Experience<sup>7</sup>  
 3 - Math Science Requirement<sup>5</sup>  
 6 - Minor Requirement<sup>4</sup> *or*  
     6 - Second Major Requirement  
 2 - Elective  
 15

122 Total Semester Hours

<sup>1</sup>Six credits in any foreign language, including American Sign Language, numbered 200 or above<sup>2</sup>CP SC 101, 111, or 120<sup>3</sup>See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Requirement.<sup>4</sup>See page 104 for approved minors.<sup>5</sup>MTHSC 308 or any 400-level MTHSC course<sup>6</sup>See advisor.<sup>7</sup>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; (3) completion of three credits of MTHSC 450 and three credits of an additional course approved by advisor; or (4) EDSEC 446 for students seeking a double major in Secondary Education-Mathematics.**Notes:**

1. For graduation, a candidate for the BA 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.

**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<sup>1</sup>
- 

**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<sup>2</sup>
  - 3 - Oral Communication Requirement<sup>1</sup>
- 

**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<sup>2</sup>
  - 3 - Social Science Requirement<sup>1</sup>
- 

**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 - Emphasis Area Requirement<sup>3</sup>
  - 3 - Physics Writing Requirement<sup>4</sup>
- 

**Second Semester**

- 1 - PHYS 300 Introduction to Research
  - 3 - PHYS 312 Methods of Theoretical Physics II
  - 3 - PHYS 322 Mechanics II
  - 3 - PHYS 326 Experimental Physics II
  - 1 - PHYS 356 Modern Physics Overview
  - 3 - PHYS 441 Electromagnetics I
  - 3 - Emphasis Area Requirement<sup>3</sup>
- 

**Senior Year****First Semester**

- 3 - PHYS 401 Senior Thesis
  - 3 - PHYS 442 Electromagnetics II
  - 3 - PHYS 455 Quantum Physics I
  - 3 - Emphasis Area Requirement<sup>3</sup>
  - 3 - Science Requirement<sup>5</sup>
- 

**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<sup>6</sup>
  - 3 - Emphasis Area Requirement<sup>3</sup>
- 

122 Total Semester Hours

<sup>1</sup>See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.<sup>2</sup>Two semesters (through 102) in the same modern foreign language are required.

<sup>3</sup>Select from department-approved list of courses in astronomy, chemistry, computer science, engineering, environmental engineering, geology, mathematical sciences, and physics. 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.

<sup>4</sup>ENGL 304, 312, 314, 315, 316, 345, 346, 348, M L 402, or THEA (ENGL) 347

<sup>5</sup>Any 200-400-level science course

<sup>6</sup>Select any ENGL course from General Education Arts and Humanities (Literature) Requirement.

**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
- 

**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<sup>1</sup>
- 

**Sophomore Year****First Semester**

- 5 - BIOL 110 Principles of Biology
  - 4 - MTHSC 206 Calculus of Several Variables
  - 3 - PHYS 221 Physics with Calculus II
  - 1 - PHYS 223 Physics Lab. II
  - 3 - Oral Communication Requirement<sup>1</sup>
- 

**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<sup>2</sup>
  - 3 - Social Science Requirement<sup>1</sup>
- 

**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 - Biophysics Requirement<sup>2</sup>
  - 4 - Foreign Language Requirement<sup>3</sup>
- 

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**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 - Biophysics Requirement<sup>2</sup>
  - 4 - Foreign Language Requirement<sup>3</sup>
- 

**Senior Year****First Semester**

- 3 - PHYS 442 Electromagnetics II
  - 3 - PHYS 455 Quantum Physics I
  - 3 - Biophysics Requirement<sup>2</sup>
  - 3 - Physics Writing Requirement<sup>4</sup>
  - 3 - Science Requirement<sup>5</sup>
- 

**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<sup>6</sup>
  - 3 - Arts and Humanities (Literature) Requirement<sup>7</sup>
  - 3 - Biophysics Requirement<sup>2</sup>
- 

125 Total Semester Hours

<sup>1</sup>See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.<sup>2</sup>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.<sup>3</sup>Two semesters (through 102) in same modern foreign language are required.<sup>4</sup>ENGL 304, 312, 314, 315, 316, 345, 346, 348, M L 402, or THEA (ENGL) 347<sup>5</sup>Any 200-400-level science course<sup>6</sup>An approved physics course may be substituted if CH 331 and 332 have been completed.<sup>7</sup>Select any ENGL course from General Education Arts and Humanities (Literature) Requirement.**PHYSICS****Bachelor of Arts**

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

**Freshman Year****First Semester**

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

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**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<sup>1</sup>
- 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<sup>2</sup>
  - 3 - Oral Communication Requirement<sup>1</sup>
- 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<sup>2</sup>
  - 3 - Social Science Requirement<sup>1</sup>
- 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 Requirement<sup>2</sup>
  - 3 - Minor Requirement<sup>3</sup>
- 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 Requirement<sup>2</sup>
  - 3 - Minor Requirement<sup>3</sup>
- 17

**Senior Year****First Semester**

- 3 - PHYS 455 Quantum Physics I
  - 6 - Minor Requirement<sup>3</sup>
  - 3 - Physics Writing Requirement<sup>4</sup>
  - 3 - Physics Requirement<sup>5</sup>
- 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) Requirement<sup>6</sup>
  - 3 - Minor Requirement<sup>3</sup>
  - 3 - Physics Requirement<sup>5</sup>
  - 3 - Elective
- 15

122 Total Semester Hours

<sup>1</sup>See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.<sup>2</sup>Four semesters (through 202) in the same modern foreign language are required.<sup>3</sup>See advisor.<sup>4</sup>ENGL 304, 312, 314, 315, 316, 345, 346, 348, M L 402, or THEA (ENGL) 347.<sup>5</sup>Any 300- or 400-level physics course<sup>6</sup>Select any ENGL course from General Education Arts and Humanities (Literature) Requirement.**POLYMER AND FIBER CHEMISTRY****Bachelor of Science**

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

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

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

**Freshman Year****First Semester**

- 4 - CH 101 General Chemistry
  - 3 - ENGL 103 Accelerated Composition
  - 4 - MTHSC 106 Calculus of One Variable I
  - 3 - TEXT 175 Intro. to Textile Manufacturing
  - 3 - History Requirement<sup>1</sup>
- 17

**Second Semester**

- 4 - CH 102 General Chemistry
  - 4 - MTHSC 108 Calculus of One Variable II
  - 3 - PHYS 122 Physics with Calculus I
  - 3 - Arts and Humanities (Non-Lit.) Requirement<sup>2</sup>
- 14

**Sophomore Year****First Semester**

- 3 - CH 223 Organic Chemistry
  - 1 - CH 227 Organic Chemistry Lab.
  - 4 - MTHSC 206 Calculus of Several Variables
  - 3 - PHYS 221 Physics with Calculus II
  - 1 - PHYS 223 Physics Lab. II
  - 3 - Arts and Humanities (Literature) Requirement<sup>3</sup>
- 15

**Second Semester**

- 3 - CH 224 Organic Chemistry
  - 1 - CH 228 Organic Chemistry Lab.
  - 3 - ECON 200 Economics Concepts
  - 3 - EN SP 200 Intro. to Environmental Science *or*  
3 - HIST 122 History, Tech., and Science *or*  
3 - HIST 124 Environmental History Survey
  - 1 - MS&E 251 Materials Science Portfolio I
  - 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 15

**Junior Year****First Semester**

- 3 - CH 331 Physical Chemistry
  - 3 - PFC 415 Intro. to Polymer Science and Engr.
  - 1 - PFC 417 Polymer and Fiber Lab.
  - 4 - TEXT 201 Yarn Structures and Formation
  - 3 - Technical Writing Requirement<sup>4</sup>
- 14

**Second Semester**

- 3 - CH 332 Physical Chemistry
  - 3 - COMM 250 Public Speaking
  - 3 - MS&E 324 Statistics for MS&E
  - 3 - PFC 416 Chemical Preparation of Textiles
  - 4 - TEXT 202 Fabric Struct., Des., and Analysis
- 16

**Senior Year****First Semester**

- 3 - PFC 457 Dyeing and Finishing I
  - 1 - PFC 459 Dyeing and Finishing I Lab.
  - 3 - TEXT 421 Fiber Science
  - 5 - Approved Requirement<sup>4</sup>
  - 3 - Departmental Requirement<sup>4</sup>
- 15

**Second Semester**

- 1 - MS&E 451 MS&E Portfolio II
  - 3 - MS&E 491 Undergraduate Research
  - 3 - PFC 458 Dyeing and Finishing II
  - 1 - PFC 460 Dyeing and Finishing II Lab.
  - 3 - TEXT 422 Properties of Textile Structures
  - 3 - Departmental Requirement<sup>4</sup>
- 14

120 Total Semester Hours

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

## MINORS

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

Accounting	Management Information Systems
Adult/Extension Education	Mathematical Sciences
Aerospace Studies	Microbiology
Agricultural Business Management	Military Leadership
Agricultural Mechanization and Business	Modern Languages
American Sign Language Studies	Music
Animal and Veterinary Sciences	Natural Resource Economics
Anthropology	Nonprofit Leadership
Athletic Leadership	Packaging Science
Biochemistry	Pan African Studies
Bioengineering	Park and Protected Area Management
Biological Sciences	Philosophy
Business Administration	Physics
Chemistry	Plant Pathology
Cluster	Political Science
Communication Studies	Psychology
Computer Science— <i>not open to Computer Information Systems majors</i>	Public Policy
Crop and Soil Environmental Science	Religion
East Asian Studies	Russian Area Studies
Economics	Science and Technology in Society
Education	Screenwriting
English	Sociology
Entomology	Spanish-American Area Studies
Entrepreneurship	Textiles— <i>not open to Polymer and Fiber Chemistry majors</i>
Environmental Engineering	Theatre
Environmental Science and Policy	Therapeutic Recreation
Equine Business	Travel and Tourism
Film Studies	Turfgrass
Financial Management	Urban Forestry
Food Science	Wildlife and Fisheries Biology
Forest Products	Women's Studies
Forest Resource Management	Writing
Genetics	
Geography	See pages 36–39 for details.
Geology	
Global Politics	
Great Works	
History	
Horticulture	
International Engineering and Science	
Legal Studies	
Management	