COLLEGE OF ENGINEERING AND SCIENCE

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

Minors
Engineering and science students can complement their majors by selecting minor concentrations of study. Available minors include Environmental Engineering, International Engineering and Science, and one in each of the science majors (see page 107).

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

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

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

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

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

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

Mathematics—Four units, including geometry, trigonometry, and introductory calculus
Laboratory Science—At least three units including both chemistry and physics
Computing—At least one unit, including introduction to a programming language. Applicants should have good keyboarding skills.

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

Freshman Curriculum

First Semester
1. 4 - CES 102 Engineering Disciplines and Skills
2. 4 - CH 101 General Chemistry
3. 3 - ENGL 103 accelerated Composition
4. 3 - ENGL 103 Accelerated Composition
5. 3 - MTHSC 106 Calculus of One Variable I
6. 3 - General Education Requirement

Second Semester
1. 4 - MTHSC 108 Calculus of One Variable II
2. 3 - PHYS 122 Physics with Calculus I
3. 3 - Departmental Freshman Engineering Req.
4. 3 - Departmental Science Requirement
5. 3 - General Education Requirement

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

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

Students should initiate a change-of-major request prior to the registration period during the semester when they expect to complete the freshman curriculum. Students who fail to meet the requirements for admission into a degree program may remain in General Engineering until those requirements are met. However, General Engineering majors are not permitted to take 300- or 400-level engineering courses. Engineering departments may allow General Engineering majors to enroll in selected 200-level engineering courses (policy varies by department). Students admitted into an engineering degree program will follow the curriculum in effect at the time of admission into General Engineering, unless otherwise approved by the specific engineering department.

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

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

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

Registration Requirements
A cumulative grade-point ratio of 2.0 or higher is required for registration in engineering courses numbered 300 or higher. Priority for registration in engineering courses is given to those majors for whom the course is a degree requirement. Exceptions to this requirement may be granted by the department offering the course.
Graduation Requirements
In addition to other institutional requirements, candidates for a baccalaureate degree in Engineering are required to have a 2.0 or higher cumulative grade-point ratio in all engineering courses taken at Clemson. All courses with “Engineering” in the course designator (e.g., ENGR 130, M E 453, etc.) are used in this calculation.

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

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

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

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

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

Second Semester
- CH 102 General Chemistry
- ENGR 141 Programming and Problem Solving
- MTHSC 108 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- Arts and Humanities Requirement1 or 2
- Social Science Requirement1
- 18

Sophomore Year
First Semester
- BIO E 201 Intro. to Biomedical Engineering
- E C E 201 Logic and Computing Devices
- E C E 202 Electric Circuits I
- E C E 209 Logic and Computing Devices Lab.
- E C E 211 Electrical Engineering Lab. I
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- 17

Second Semester
- C E 201 Statics
- E C E 212 Electrical Engineering Lab. II
- E C E 262 Electric Circuits II
- MSS&E 210 Introduction to Materials Science
- MTHSC 208 Intro. to Ordinary Diff. Equations
- 14

Junior Year
First Semester
- CH 201 Survey of Organic Chemistry
- E C E 311 Electrical Engineering Lab. III
- E C E 320 Electronics I
- E C E 332 Signals, Systems, and Transforms
- E C E 350 Electromagnetics
- Arts and Humanities Requirement1 or 2
- Social Science Requirement1
- 17

Second Semester
- BIO E 320 Biomaterials
- BIO E 330 Biomechanics
- BIOE 305 Essential Elements of Biochem.
- Arts and Humanities Requirement1 or 2
- Social Science Requirement1
- Bioengineering or E C E Technical Requirement1
- 15

Senior Year
First Semester
- BIO E 320 Biomaterials
- BIO E 401 Bioengineering Design Theory
- BIOSC 315 Functional Human Anatomy
- BIOSC 461 Cell Biology
- BIOSC 462 Cell Biology Lab.
- 15

Second Semester
- BIO E 400 Senior Seminar
- BIO E 403 Applied Biomedical Design
- BIO E 448 Tissue Engineering
- Arts and Humanities Requirement1 or 2
- Social Science Requirement1
- Bioengineering or E C E Technical Requirement1
- 16

128 Total Semester Hours

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

Notes:
1. To transfer from General Engineering into the Bioengineering degree program, students must have a minimum cumulative grade-point ratio of 3.0 in courses taken at Clemson and must have earned a C or better in each course in the General Engineering freshman curriculum, including the Arts and Humanities/Social Science Requirements.
2. A student is allowed to enroll in any E C E course (excluding E C E 301, 302, 303) 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-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
- CES 102 Engineering Disciplines and Skills
- CH 101 General Chemistry
- ENGL 103 Accelerated Composition
- MTHSC 108 Calculus of One Variable I
- Arts and Humanities Requirement1 or 2
- Social Science Requirement1
- 16

Second Semester
- CH 102 General Chemistry
- ENGR 141 Programming and Problem Solving
- MTHSC 106 Calculus of One Variable I
- PHYS 122 Physics with Calculus I
- Arts and Humanities Requirement1 or 2
- Social Science Requirement1
- Biology Requirement1
- 18

Sophomore Year
First Semester
- BIO E 201 Intro. to Biomedical Engineering
- CH 201 Survey of Organic Chemistry
- E C E 201 Logic and Computing Devices
- E C E 202 Electric Circuits I
- E C E 209 Logic and Computing Devices Lab.
- E C E 211 Electrical Engineering Lab. I
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- 17

Second Semester
- BIO E 302 Biomaterials
- BIO E 330 Biomechanics
- BIOE 305 Essential Elements of Biochem.
- Arts and Humanities Requirement1 or 2
- Social Science Requirement1
- Bioengineering or E C E Technical Requirement1
- 15

Senior Year
First Semester
- BIO E 320 Biomaterials
- BIO E 401 Bioengineering Design Theory
- BIOSC 315 Functional Human Anatomy
- BIOSC 461 Cell Biology
- BIOSC 462 Cell Biology Lab.
- 15

Second Semester
- BIO E 400 Senior Seminar
- BIO E 403 Applied Biomedical Design
- BIO E 448 Tissue Engineering
- Arts and Humanities Requirement1 or 2
- Social Science Requirement1
- Bioengineering or E C E Technical Requirement1
- 16

128 Total Semester Hours
Junior Year

First Semester
- BIO E 320 Biomechanics
- BIOE 315 Functional Human Anatomy
- MS&E 319 Materials Processing I
- MS&E 326 Thermodynamics of Materials
- MS&E 327 Transport Phenomena
16

Second Semester
- BIOCH 305 Essential Elements of Biochem.
- BIO E 321 Biofluid Mechanics
- MTHSC 302 Statistics for Science and Engr.
- Bioengineering Technical Requirement3
- Arts and Humanities Requirement1 or
  - Social Science Requirement1
15

Senior Year

First Semester
- BIO E 370 Bioinstrumentation and Bioimaging
- BIO E 401 Bioengineering Design Theory
- BIO SC 461 Cell Biology
- MS&E 415 Intro, to Polymer Science and Engr.
- Bioengineering Technical Requirement3
15

Second Semester
- BIO E 400 Senior Seminar
- BIO E 403 Applied Biomedical Design
- BIO E 448 Tissue Engineering
- Arts and Humanities Requirement1 or
  - Social Science Requirement1
- Bioengineering Technical Requirement3
16

128 Total Semester Hours

3See 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.

Students planning to enter medical school should take 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).

Note: Transfer from General Engineering into the Bioengineering degree program 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 88, Biosystems Engineering students should achieve familiarity with both biosystems concentrations, experience an interdisciplinary education, and develop a career goal of professional recognition and licensure.

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

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

Students are urged to complete a minor and participate in off-campus activities. Students interested in medical careers should consider graduate study and/or medical school.

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

Combined Bachelor’s/Master’s Program

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

Undergraduate students in Biosystems Engineering may begin a Master of Science or a Master of Engineering Degree in Environmental Engineering and Science or Master of Science Degree in Bioengineering while completing the BS degree.

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

Freshman Year

First Semester
- CES 102 Engineering Disciplines and Skills
- CH 101 General Chemistry
- CH 102 General Chemistry
- ENG R 130 Engineering Fundamentals
- MTHSC 108 Calculus of One Variable I
- Arts and Humanities Requirement1 or
  - Social Science Requirement1
16

Second Semester
- CH 103 General Chemistry
- ENG R 131 Engineering Fundamentals
- MTHSC 109 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- Arts and Humanities Requirement1 or
  - Social Science Requirement1
16

Sophomore Year

First Semester
- B E 210 Intro. to Biosystems Engineering
- C E 201 Statics1
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- Thermodynamics Requirement3
17

Second Semester
- B E 212 Fundamentals of Biosystems Engr.
- C E 208 Dynamics1
- C E 210 Computer-Aided Design and Engineering Applications
- M E 310 Thermodynamics and Heat Transfer or
  - CH E 220 Chem. Engr. Thermodynamics I
- MICRO 305 General Microbiology
- MTHSC 208 Intro. to Ordinary Diff. Equations
17

Junior Year

First Semester
- B E 222 Geomeasurements
- B E 410 Biol. Kinetics and Reactor Modeling
- CH 223 Organic Chemistry
- CH 227 Organic Chemistry Laboratory
- C E 307 Basic Electrical Engineering
- Mechanics of Materials Requirement4
- Arts and Humanities Requirement1 or
  - Social Science Requirement1
17

Second Semester
- B E 322 Small Watershed Hydrology and Sedimentology
- B E 412 Heat and Mass Transport in B E
- B E 415 Instrumentation and Control for Biosystems Engineers
- B E 438 Bioprocess Engineering Design
- C E 341 Introduction to Fluid Mechanics
17

0See 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.

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

1 or 2M E 201 may be substituted for C E 201 and 208

1 or 2B IOL 103/105 or 110

1 or 2C E 206 or M E 302
BIOPROCESS ENGINEERING EMPHASIS AREA

Senior Year

First Semester
3 - B E 428 Biochemical Engineering
2 - B E 474 Biosystems Engr. Design/Project Mgt.
3 - BIOCH 305 Essential Elements of Biochemistry
2 - BIOSC 434 Biological Chemistry Lab. Techniques
3 - BIOSC 441 Ecology
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Second Semester
2 - B E 475 Biosystems Engr. Capstone Design
6 - Engineering Requirement2
3 - Life Science Requirement3
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
14

129 Total Semester Hours

3See 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.
1B E 34, 408, 414, 427, 440, 464, 473, 484, C E 321, 352, 402, 406, 482, EES& 451, 452, 410, 430, 480, 484, 485, 486,
1 E 384, GEOL 421, or any other pre-approved engineering course. Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Engineering Requirements.
2Any BIOCH, BIOSC, BIOL, CH, CSENV, GEN, MICRO or W F B course at the 300 level or higher.

ECOLOGICAL ENGINEERING EMPHASIS AREA

Senior Year

First Semester
2 - B E 474 Biosystems Engr. Design/Project Mgt.
3 - BIOSC 441 Ecology
3 - Ecological Requirement1
3 - Engineering Requirement1
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
14

Second Semester
2 - B E 421 Engineering Systems for Soil Water Mgt.
3 - B E 424 Ecological Engineering
2 - B E 475 Biosystems Engr. Capstone Design
3 - Ecological Requirement1
3 - Engineering Requirement1
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

129 Total Semester Hours

1B E 464, BIOCS 410, 413, 428, 443, 446, CSENV 202, ENTOX 437, F N R 466, GEOL 408
1B E 434, 408, 414, 417, 422, 440, 464, 473, 484, C E 321, 352, 402, 406, 482, EES& 451, 452, 410, 430, 480, 484, 485, 486,
1 E 384, GEOL 421, or any other pre-approved engineering course. Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Engineering Requirements.
3See 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.

Notes:
1. Biosystems Engineering students are allowed to enroll in upper-level B E courses only when the following prerequisites have been completed with C or better: C E 201, 206, 208, 341, CH E 220, 230, M E 201, 302, 310, MTHSC 206, 208, PHYS 221.
2. Biosystems Engineering students are encouraged to complete a minor, cooperative education program, internship (B E 370) and/or study abroad program. Probable minors include Environmental Engineering or Environmental Science and Policy.
3. A Departmental Honors Thesis (B E H300/H301/H400) is available to qualified juniors and seniors.
4. Biosystems Engineering majors are encouraged to consider possibilities of graduate study early in the undergraduate program and plan accordingly, including the possibility of participating in the Combined Bachelor’s/Master’s Program, wherein six credits may count in both the BS and MS-degree. Probable graduate programs include Biosystems Engineering, Environmental Engineering, and other engineering and non-engineering programs. An agreement exists for the Combined Bachelor’s/Master’s Program in Biosystems Engineering.
5. Students are required to update their portfolios for each course completed.

CHEMICAL ENGINEERING

Bachelor of Science

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

Chemical engineering is based on chemistry, biology, physics, and mathematics. The curriculum at Clemson includes classroom and laboratory instruction and emphasizes broadly applicable fundamental principles and current technology to prepare graduates for professional practice and professional growth. The Educational Objective of the BS degree program is for graduates to have careers characterized by:
• Demonstrated success in the design of chemical processes and/or identification, formulation, and solution of chemical engineering problems;
• Efficient behavior in all endeavors;
• Demonstrated effectiveness in teamwork, communication, and service to society through professional contributions;
• Demonstrated technical and/or managerial leadership;
• Demonstrated commitment to lifelong learning.

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

Combined Bachelor of Science/Master of Science

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

Freshman Year

First Semester
2 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 103 General Chemistry
4 - MTHSC 106 Calculus of One Variable I
3 - Social Science Requirement1 or
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Second Semester
4 - CH 102 General Chemistry
2 - CH E 130 Chemical Engineering Tools
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Sophomore Year

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

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

Junior Year

First Semester
3 - BIOCS 305 Essential Elements of Biochem.
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 - EX ST 411 Statistical Methods for Process Development and Control
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College of Engineering and Science

Senior Year
First Semester
- CH E 407 Unit Operations Lab. II
- CH E 431 Chemical Process Design I
- CH E 443 Chemical Engr. Senior Seminar I
- MICRO 413 Industrial Microbiology
- Arts and Humanities Requirement1 or
- Social Science Requirement1
- Emphasis Area Requirement2

Second Semester
- CH E 353 Process Dynamics and Control
- CH E 444 Chemical Process Design II
- CH E 391 Engineering Materials
- EX ST 411 Statistical Methods for Process Development and Control
- MTHSC 208 Intro. to Ordinary Diff. Equations

Sophomore Year
First Semester
- BIOL 110 Principles of Biology I
- CH 223 Organic Chemistry
- MTHSC 206 Calculus of Several Variables
- Arts and Humanities Requirement1 or
- Social Science Requirement1

Second Semester
- BIOC 305 Essential Elements of Biochemistry
- BIOSC 433 Biological Chem. Lab. Techniques
- CH 224 Organic Chemistry
- CH E 220 Chemical Engr. Thermodynamics I
- CH E 230 Fluids/Heat Transfer

Junior Year
First Semester
- BIOC 431 Physical Approach to Biochemistry
- CH E 307 Unit Operations Lab. I
- CH E 319 Engineering Materials
- EX ST 411 Statistical Methods for Process Development and Control
- MTHSC 208 Intro. to Ordinary Diff. Equations

Second Semester
- BIOC 302 Biotechnologies
- BMOLE 425 Biomolecular Engineering
- CH E 321 Chemical Engr. Thermodynamics II
- PHYS 223 Physics with Calculus II

Senior Year
First Semester
- CH E 407 Unit Operations Lab. II
- CH E 431 Chemical Process Design I
- CH E 443 Chemical Engr. Senior Seminar I
- CH E 450 Chemical Reaction Engineering
- Arts and Humanities Requirement1 or
- Social Science Requirement1
- Engineering Requirement2

Second Semester
- CH E 353 Process Dynamics and Control
- CH E 433 Process Design II
- CH E 444 Chemical Engr. Senior Seminar II
- CH E 407 Unit Operations Lab. I
- CH E 391 Engineering Materials
- Arts and Humanities Requirement1 or
- Social Science Requirement1
- Engineering Requirement2

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

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

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

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

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

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

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

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

Second Semester
- ENGR 130 Engineering Fundamentals
- GEOL 101 Physical Geology
- GEOL 103 Physical Geology Lab.
- MTHSC 106 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- PHYS 124 Physics Lab. I
- Arts and Humanities Requirement1 or
- Social Science Requirement1

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

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

2See advisor for details. Nine credit hours devoted to completion of an emphasis area or approved minor are required. Emphasis areas are Applied Engineering, Mathematics, and Science; Biomolecular Science and Engineering; Business Management; Environmental Engineering; Polymers Materials; Energy Studies.

3Select from CH E 401 or BMOLE 403; BMOLE 423, 426, 427, B E 428, MICRO 413.

4Note: No student may exceed a maximum of two attempts, including a W, to complete successfully any CH E course.

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COMPUTER ENGINEERING

Bachelor of Science

Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology Education. 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. All Computer Engineering students must have a cumulative engineering grade-point ratio of 2.0 to enroll in any 400-level E C E courses.

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 400-level E C E courses.

Sophomore Year

First Semester
- MTHSC 208 Intro. to Ordinary Diff. Equations
- 4 - C E 352 Economic Evaluation of Projects
- 3 - C E 255 Geomatics
- 3 - PHYS 221 Physics with Calculus II
- 2 - E G 210 Intro. to Engr./Computer Graphics
- 2 - E C E 272 Computer Organization
- 2 - E C E 209 Logic and Computing Devices Lab.
- 3 - CP SC 111 Elementary Computer

Second Semester
- MTHSC 108 Calculus of One Variable II
- 3 - Arts and Humanities Requirement1
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 419 Discrete Math. Structures I
- 3 - Computer Engineering Technical Depth Req.2
- 3 - E C E 409 Continuous and Discrete Sys. Design
- 3 - COMM 250 Public Speaking
- 3 - Computer Engineering Technical Requirement2

Junior Year

First Semester
- E C E 307 Electromagnetic Fields
- 4 - MTHSC 207 Linear Algebra
- 3 - E C E 371 Microcontroller Interfacing
- 3 - E C E 330 Signals, Systems, and Transforms
- 4 - E C E 320 Electronics I
- 1 - E C E 311 Electrical Engineering Lab. III
- 3 - E C E 223 Computer Systems Engineering
- 2 - E C E 307, 308, 309

Second Semester
- E C E 312 Electronic Circuits I
- 3 - Arts and Humanities Requirement1
- 3 - E C E 350 Computer Engineering Lab.
- 3 - Arts and Humanities Requirement1
- 3 - E C E 317 Random Signal Analysis
- 3 - E C E (CP SC) 322 Intro. to Operating Systems
- 2 - E C E 307, 308, 309

Senior Year

First Semester
- E C E 376 Integrated System Design I
- 3 - Arts and Humanities Requirement1
- 3 - E C E 352 Programming Systems
- 3 - E C E 327 Digital Computer Design
- 3 - E C E 326 Microprocessors
- 3 - E C E 326 Microprocessors
- 3 - E C E 326 Microprocessors
- 3 - E C E 326 Microprocessors

Second Semester
- E C E 496 Integrated System Design II
- 3 - Arts and Humanities Requirement1
- 3 - E C E 409 Continuous and Discrete Sys. Design
- 3 - Computer Engineering Technical Requirement2
- 3 - Computer Engineering Technical Requirement2
- 3 - Computer Engineering Technical Requirement2
- 3 - Computer Engineering Technical Requirement2
- 3 - Computer Engineering Technical Requirement2

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 400-level E C E courses.

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 400-level E C E courses.
ELECTRICAL ENGINEERING

Bachelor of Science

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

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

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

Freshman Year

First Semester
1. CES 102 Engineering Disciplines and Skills
2. CH 101 General Chemistry
3. ENGL 103 Accelerated Composition
4. MTH 106 Calculus of One Variable I
3. Arts and Humanities Requirement\(^1\) or
   - Social Science Requirement\(^1\)

Second Semester
1. ECE 212 Electrical Engineering Lab. II
2. ECE 262 Electric Circuits II
3. ECE 272 Computer Organization
4. ECE 273 Computer Organization Laboratory
3. Arts and Humanities Requirement\(^2\) or
   - Social Science Requirement\(^2\)
   - Electrical Engineering Technical Req.\(^3\)

Junior Year

First Semester
1. ECE 311 Electrical Engineering Lab. III
2. ECE 320 Electronics I
3. ECE 330 Signals, Systems, and Transforms
4. ECE 360 Electric Power Engineering
3. ECE 380 Electromagnetics
3. Advanced Mathematics Requirement\(^4\)

Second Semester
1. ECE 312 Electrical Engineering Lab. IV
2. ECE 317 Random Signal Analysis
3. ECE 321 Electronics II
4. ECE 371 Microcontroller Interfacing
1. ECE 372 Microcontroller Interfacing Lab.
3. ECE 381 Fields, Waves, and Circuits
3. ENGL 314 Technical Writing

Senior Year

First Semester
1. COMM 450 Intro. to Human Comm. or
2. COMM 450 Public Speaking
3. ECE 470 Continuous and Discrete Syst. Des.
4. ECE 472 Communications Systems
2. ECE 495 Integrated Systems Design I
3. Electrical Engineering Technical Req.\(^5\)

Second Semester
1. ECE 496 Integrated System Design II
3. Arts and Humanities Requirement\(^1\) or
   - Social Science Requirement\(^1\)
   - Arts and Humanities Requirement\(^2\)
   - Electrical Engineering Technical Req.\(^3\)
2. ECE 497 Technical Writing

Sophomore Year

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

Second Semester
1. ECE 212 Electrical Engineering Lab. II
2. ECE 262 Electric Circuits II
3. ECE 272 Computer Organization
4. ECE 273 Computer Organization Laboratory
4. MTH 208 Intro. to Ordinary Diff. Equations
3. Arts and Humanities Requirement\(^2\) or
   - Social Science Requirement\(^2\)
   - Electrical Engineering Technical Req.\(^3\)

Notes:
1. A student is allowed to enroll in ECE courses (excluding ECE 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 ECE courses.
3. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any ECE course.

ENVIRONMENTAL ENGINEERING

Bachelor of Science

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

The curriculum for the Bachelor of Science degree in Environmental Engineering consists of 128-130 credit hours and the Natural Systems Concentration also consists of 128-130 credit hours. The first two years of the program are common for all students enrolled in the degree. In the junior and senior years, students may select a core curriculum that emphasizes areas traditionally associated with environmental engineering, such as water and wastewater management, solid and hazardous waste management, air pollution control, pollution prevention and risk assessment. Alternatively, students entering their junior year may choose the Natural Systems Concentration, which places a greater emphasis on environmental processes in natural environments. All students participate in two professional seminar courses and complete a capstone design project.

Freshman Year

First Semester
2. CES 102 Engineering Disciplines and Skills
4. CH 101 General Chemistry
3. ENGR 141 Programming and Problem Solving
4. MTH 106 Calculus of One Variable II
3. Arts and Humanities Requirement\(^1\) or
   - Social Science Requirement\(^1\)

Second Semester
1. ECE 212 Electrical Engineering Lab. II
2. ECE 262 Electric Circuits II
3. ECE 272 Computer Organization
4. ECE 273 Computer Organization Laboratory
3. Arts and Humanities Requirement\(^2\) or
   - Social Science Requirement\(^2\)
   - Electrical Engineering Technical Req.\(^3\)

Third Semester
2. COMM 150 Intro. to Human Comm. or
1. ECE 212 Electrical Engineering Lab. II
3. Arts and Humanities Requirement\(^1\) or
   - Social Science Requirement\(^1\)
3. Arts and Humanities Requirement\(^2\)
2. ECE 262 Electric Circuits II
3. Arts and Humanities Requirement\(^2\)
1. ECE 212 Electrical Engineering Lab. II
3. Arts and Humanities Requirement\(^2\)
2. ECE 262 Electric Circuits II
3. Arts and Humanities Requirement\(^2\)
1. ECE 212 Electrical Engineering Lab. II
Sophomore Year

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

Second Semester
1. CH 201 Survey of Organic Chemistry or
2. CH 223 Organic Chemistry and
3. CH 227 Organic Chemistry Laboratory
4. C E 208 Dynamics
5. EE&S 202 Environmental Engineering Fund. II
6. MTHSC 208 Intro. to Ordinary Diff. Equations

Junior Year

First Semester
4. C E 341 Introduction to Fluid Mechanics
5. EE&S 430 Air Pollution Engineering
6. MICRO 305 General Microbiology
7. Arts and Humanities Requirement or
8. Social Science Requirement
9. Statistics Requirement

Second Semester
4. CH 102 General Chemistry
5. ENGR 130 Engineering Fundamentals
6. MTHSC 108 Calculus of One Variable I
7. PHYS 122 Physics with Calculus I
8. Arts and Humanities Requirement
9. Social Science Requirement

Senior Year

First Semester
1. BIOL 103 General Biology and
2. BIOL 105 General Biology Laboratory or
3. BIOL 110 Principles of Biology
4. C E 201 Statics
5. EE&S 201 Environmental Engineering Fund. I
6. MTHSC 208 Intro. to Ordinary Diff. Equations

Second Semester
4. CH 201 Survey of Organic Chemistry or
5. CH 223 Organic Chemistry and
6. CH 227 Organic Chemistry Laboratory
7. C E 208 Dynamics
8. EE&S 202 Environmental Engineering Fund. II
9. MTHSC 208 Intro. to Ordinary Diff. Equations

Junior Year

First Semester
4. C E 341 Introduction to Fluid Mechanics
5. CSENV 450 Environ. Engr. Senior Seminar
6. EE&S 402 Water and Wastewater Treatment
7. Engineering or Science Requirement
8. Social Science Requirement

Second Semester
4. CH 102 General Chemistry
5. ENGR 130 Engineering Fundamentals
6. MTHSC 108 Calculus of One Variable I
7. PHYS 122 Physics with Calculus I
8. Arts and Humanities Requirement
9. Social Science Requirement

First Semester
3. EE&S 475 Capstone Design Project
4. EE&S 485 Hazardous Waste Management
5. Natural Systems Engineering Requirement
6. Arts and Humanities Requirement
7. Social Science Requirement

Second Semester
4. CH 201 Survey of Organic Chemistry or
5. CH 223 Organic Chemistry and
6. CH 227 Organic Chemistry Laboratory
7. C E 208 Dynamics
8. EE&S 202 Environmental Engineering Fund. II
9. MTHSC 208 Intro. to Ordinary Diff. Equations

INDUSTRIAL ENGINEERING

Bachelor of Science

Industrial engineers design, install, and improve the complex systems that provide goods and services vital to our society and economy. These systems place unique demands for breadth of preparation on industrial engineers. The Industrial Engineering baccalaureate program prepares graduates to: (1) design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy using appropriate analytical, computational, and experimental practices; (2) apply information technologies to the practice of industrial engineering; (3) conduct themselves in a professional and ethical manner; and (4) work and communicate effectively with colleagues at every level in the organization.

The traditional arenas for the practice of industrial engineering are the manufacturing facilities of industry; however, many practicing industrial engineers are employed in non-manufacturing institutions such as hospitals, banks, and government agencies. In addition to numerous employment opportunities in professional practice, industrial engineering graduates may further their formal education. The Department of Industrial Engineering offers programs leading to the Master of Science and Doctor of Philosophy degrees.
The Department of Industrial Engineering allows students to count up to 12 hours of graduate credit (approved 600- and 800-level courses) toward both the bachelor’s and master’s degrees. Students participating in this program must have a minimum grade-point ratio of 3.4 and be admitted to the Graduate School prior to registering for graduate courses. Details of the suggested curriculum and program information are available from the Industrial Engineering Department.

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

Freshman Year
First Semester
2 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement 1 or
3 - Social Science Requirement 1
3
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 1 or
3 - Social Science Requirement 1
4 - Lab Science Requirement 2
16
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 3
16
Second Semester
3 - C E 201 Statics 4
2 - E G 208 Engineering Graphics with Computer Applications or
2 - E G 209 Introduction to Engineering/Computer Graphics
3 - I E 210 Design and Analysis of Work Systems
3 - I E 384 Engineering Economic Analysis
3 - MS&E 210 Introduction to Materials Science
3 - Arts and Humanities Requirement 1 or
3 - Social Science Requirement 1
17
Junior Year
First Semester
2 - C E 208 Dynamics 4
3 - I E 360 Design and Control of Industrial Sys. I
1 - I E 368 Professional Practice in I E
3 - I E 440 Decision Support Systems in I E
3 - Arts and Humanities Requirement 1 or
3 - Social Science Requirement 1
3 - Mathematics or Natural Science Req. 2
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 Design and Control of Industrial Sys. II
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 2
3 - Technical Requirement 2
16
Second Semester
3 - I E 467 Systems Design II
3 - Arts and Humanities Requirement 1 or
3 - Social Science Requirement 1
3 - Management Requirement 2
3 - Technical Requirement 2
12
124 Total Semester Hours
3See policy on Humanities and Social Sciences for Engineering curricula.
3Select from department-approved list. See advisor.
3PHYS 124 may be substituted.
3M E 201 may be substituted for C E 201 and 208; E M 202 may be substituted for C E 208.

MATERIALS SCIENCE AND ENGINEERING
Bachelor of Science
Materials scientists and engineers design, develop, and produce traditional and new advanced materials with diverse applications intended for use in a wide variety of industries. These include traditional materials-intensive industries such as structural clay, foundry, whiteware, polymers, plastics, fibers, textiles, composite materials, and automotive industries. Also included are high performance technology industries such as semiconductor, defense, biomaterials, aerospace, and communication industries. The broad career responsibilities of this discipline require competence in science, engineering, mathematics, and the social sciences. The curriculum develops skills in problem solving, engineering analysis, and design, as well as oral and written communication.

The School of Materials Science and Engineering offers two areas of concentration within the Bachelor of Science degree in Materials Science and Engineering. The Inorganic Materials Concentration provides for more in-depth study of the engineering and science of materials such as ceramics, glasses, metals, optical and electronic materials; while the Polymeric Materials Concentration provides more emphasis on plastics, elastomers, fibers and fibrous materials, films, coatings and adhesives. Students select either the Inorganic Materials Concentration or the Polymeric Materials Concentration at the beginning of their sophomore year. Both concentrations in Materials Science and Engineering integrate laboratory with classroom experiences to prepare students for life-long learning and exciting career opportunities. Courses covering thermodynamics, kinetics, mechanical behavior, processing, fabrication and characterization of materials prepare students for careers in industry and for graduate school.

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

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

Specifically, the Accreditation Board for Engineering and Technology Engineering Criteria 2011 requires that baccalaureate degree graduates in Materials Science and Engineering be able to:

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

INORGANIC MATERIALS CONCENTRATION
Freshman Year
First Semester
2 - CES 102 Engineering Disciplines and Skills
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement 1 or
3 - Social Science Requirement 1
16
Second Semester
4 - CH 102 General Chemistry
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 1 or
3 - Social Science Requirement 1
17
Sophomore Year
First Semester
4 - CH 201 Survey of Organic Chemistry
3 - MS&E 210 Introduction to Materials Science
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
3 - Arts and Humanities Requirement 1 or
3 - Social Science Requirement 1
17
### MECHANICAL ENGINEERING

#### Bachelor of Science

Breath, 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 (EGFPr) 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 EGFPr 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.

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### POLYMERIC MATERIALS CONCENTRATION

#### Freshman Year

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

**Second Semester**
- C E 201 Statics
- M & E 241 Metrics Laboratory
- MTHSC 208 Intro. to Ordinary Diff. Equations
- Arts and Humanities Requirement1 or Social Science Requirement1

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**Sophomore Year**

**First Semester**
- CH 223 Organic Chemistry
- CH 227 Organic Chemistry Laboratory
- M & E 210 Introduction to Materials Science
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- Arts and Humanities Requirement1 or Social Science Requirement1

**Second Semester**
- C E 201 Statics
- CH 224 Organic Chemistry
- CH 228 Organic Chemistry Laboratory
- M & E 250 Polymer & Fiber Science I
- MTHSC 208 Intro. to Ordinary Diff. Equations

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**Junior Year**

**First Semester**
- CH 331 Physical Chemistry
- COMM 250 Public Speaking
- M & E 422 Mechanical Behavior or Materials
- MS & E 455 Polymer and Fiber Lab.
- Arts and Humanities Requirement1 or Social Science Requirement1

**Second Semester**
- CH 332 Physical Chemistry
- E E 381 Engineering Economic Analysis
- M & E 422 Mechanical Behavior or Materials
- M & E 456 Polymer and Fiber Science II
- EX ST 301 Introductory Statistics or MTHSC 302 Statistics for Science and Engr.

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**Senior Year**

**First Semester**
- MS & E 458 Surface Phenomena in Materials Science and Engineering
- MS & E 460 Surface Phenomena in Materials Science and Engineering Laboratory
- MS & E 461 Polymer and Fiber Science III
- MS & E 491 Undergraduate Research
- Technical Requirement2

**Second Semester**
- MS & E 407 Senior Capstone Design
- MS & E 445 Practice of Materials Engineering
- MS & E 457 Color Science
- Arts and Humanities Requirement1 or Social Science Requirement1
- Technical Requirement2

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**124 Total Semester Hours**

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

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

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.
3 - Arts and Humanities Requirement or
3 - Social Science Requirement or

Sophomore Year
First Semester
1 - M E 200 Sophomore Seminar
5 - M E 201 Statics and Dynamics for Mech. Engr.
2 - M E 222 Mechanical Engineering Lab. I or
3 - M.E 210 Intro. to Materials Science
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
15-16

Second Semester
2 - E C E 307 Basic Electrical Engineering
1 - E C E 309 Electrical Engineering Lab. I
3 - M E 202 Foundations of Mechanical Systems
3 - M E 203 Found. of Thermal and Fluid Systems
2 - M E 222 Mechanical Engineering Lab. I or
3 - M.S&E 210 Intro. to Materials Science
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
15-16

Junior Year
First Semester
3 - ENG 314 Technical Writing
3 - M E 302 Mechanics of Materials
3 - M E 308 Fluid Mechanics
2 - M E 333 Mechanical Engineering Lab. II or
3 - Statistics Requirement 1,2
3 - MTHSC 365 Numerical Methods for Engineers
3 - Arts and Humanities Requirement or
3 - Social Science Requirement or
17-18

Second Semester
3 - M E 303 Thermodynamics
3 - M E 304 Heat Transfer
3 - M E 305 Model. and Analysis of Dynamic Syst.
3 - M E 306 Fundamentals of Machine Design
2 - M E 333 Mechanical Engineering Lab. II or
3 - Statistics Requirement 1,2
14-15

Senior Year
First Semester
3 - M E 312 Manufacturing Processes and Their Application
3 - M E 401 Mechanical Engineering Design
2 - M E 444 Mechanical Engineering Lab. III or
3 - Arts and Humanities Requirement or
3 - Social Science Requirement or
6 - Technical Requirement
14-15

Second Semester
1 - M E 400 Senior Seminar
3 - M E 402 Internship in Engineering Design
3 - M E 403 Control and Integration of Multi-Domain Dynamic Systems
2 - M E 444 Mechanical Engineering Lab. III or
3 - Arts and Humanities Requirement or
3 - Social Science Requirement or
3 - Technical Requirement or
15-16

125 Total Semester Hours
Notes:
1. A student is not 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. A student must exceed three attempts to complete successfully M E 201, 202, or 203. Registration for a third attempt to complete any of these M E courses requires the approval of the director of the Mechanical Engineering Department. A grade of W counts as an unsuccessful attempt in completing the course.
3. For students repeating an M E course, registration preference will be given to students in a degree granting program, and the curriculum requires the course in question.

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

The science departments in the College work closely with the other academic departments in the University, including such disciplines as economics and management as well as engineering. This allows students in the sciences the 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 107. 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 or
3 - Social Science Requirement or
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 or
3 - Social Science Requirement or
16
### Sophomore Year

**First Semester**
- CH 223 Organic Chemistry
- CH 227 Organic Chemistry Lab.
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- PHYS 223 Physics Lab. II
- Foreign Language Requirement

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

### Junior Year

**First Semester**
- BIOCH 301 Molecular Biochemistry
- CH 313 Quantitative Analysis
- CH 315 Quantitative Analysis Lab.
- CH 331 Physical Chemistry
- CH 339 Physical Chemistry Lab.
- ENGL 314 Technical Writing

**Second Semester**
- CH 332 Physical Chemistry
- CH 340 Physical Chemistry Lab.
- CH 411 Instrumental Analysis
- CH 412 Instrumental Analysis Lab.
- Arts and Humanities (Literature) Requirement
- Elective

### Senior Year

**First Semester**
- CH 402 Inorganic Chemistry
- CH 403 Advanced Synthetic Techniques
- CH 443 Research Problems
- Arts and Humanities Requirement
- Social Science Requirement
- Chemistry Requirement

**Second Semester**
- CH 444 Research Problems
- CH 452 Chemistry Capstone
- CH 452 Chemistry Communication II
- Arts and Humanities Requirement
- Social Science Requirement
- Chemistry Requirement
- Elective

122 Total Semester Hours

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### CHEMISTRY

**Bachelor of Arts**

**Freshman Year**

**First Semester**
- CH 101 General Chemistry
- CH 141 Chemistry Orientation
- ENGL 103 Accelerated Composition
- MTHSC 106 Calculus of One Variable I
- Arts and Humanities Requirement
- Social Science Requirement

**Second Semester**
- CH 102 General Chemistry
- CH 152 Chemistry Communication I
- MTHSC 108 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- Arts and Humanities Requirement
- Social Science Requirement

**Sophomore Year**

**First Semester**
- CH 223 Organic Chemistry
- CH 227 Organic Chemistry Lab.
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- Foreign Language Requirement

**Second Semester**
- CH 205 Introduction to Inorganic Chemistry
- CH 224 Organic Chemistry
- CH 228 Organic Chemistry Lab.
- MTHSC 208 Intro. to Ordinary Diff. Equations
- PHYS 222 Physics with Calculus III
- Foreign Language Requirement

**Junior Year**

**First Semester**
- CH 313 Quantitative Analysis
- CH 317 Quantitative Analysis Lab.
- Arts and Humanities Requirement
- Social Science Requirement
- Chemistry Requirement

**Second Semester**
- CH 332 Physical Chemistry
- Arts and Humanities Requirement
- Social Science Requirement
- Chemistry Requirement
- Elective

**Senior Year**

**First Semester**
- Arts and Humanities (Literature) Requirement
- Foreign Language Requirement
- Minor Requirement

**Second Semester**
- Arts and Humanities (Non-Lit.) Requirement
- Natural Science Requirement
- Social Science Requirement

122 Total Semester Hours

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### 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 system 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**
- CP SC 101 Computer Science I
- ENGL 103 Accelerated Composition
- MTHSC 102 Intro. to Mathemat. Analysis
- Elective
- MTHSC 106 Calculus of One Variable I
- Natural Science Requirement

**Second Semester**
- CP SC 102 Computer Science II
- MTHSC 207 Multivariable Calculus
- Elective
- MTHSC 108 Calculus of One Variable II
- Arts and Humanities (Non-Lit.) Requirement
- Natural Science Requirement

**Sophomore Year**

**First Semester**
- CP SC 207 Discrete Structures for Computing
- CP SC 212 Algorithms and Data Structures
- Arts and Humanities (Literature) Requirement
- Oral Communication Requirement
- Social Science Requirement

**Second Semester**
- CH 450 Chemistry Capstone
- CH 452 Chemistry Communication II
- Chemistry Requirement
- Minor Requirement
- Elective

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

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

3See advisor.
Second Semester
3 - CP SC 215 Software Development Foundations
4 - CP SC 231 Intro. to Computer Organization
1 - CP SC 291 Seminar in Professional Issues I
3 - MGT 201 Principles of Management
3 - Probability and Statistics Requirement4

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 Requirement5

Second Semester
3 - ACCT 202 Managerial Accounting Concepts
3 - CP SC 360 Networks and Network Program.
3 - CP SC 371 Systems Analysis or
3 - MGT 452 Systems Analysis and Design
3 - ECON 211 Principles of Microeconomics
3 - Computer Science Requirement6

Senior Year
First Semester
3 - CP SC 420 Computer Security Principles or
3 - CP SC 424 System Admin. and Security
3 - CP SC 462 Database Management Systems
3 - CP SC 491 Seminar in Professional Issues II
3 - Business Requirement7
3 - Computer Science Requirement6

Second Semester
3 - MGT 312 Decision Models for Management
3 - MKT 301 Principles of Marketing
3 - Computer Science Requirement6
3 - Information Systems Requirement8

122 Total Semester Hours

Notes:
1. Select either the MTHSC 102/207 or 106/108 sequence. Students who select the 106/108 sequence will have satisfied the two elective credits in the freshman year.
2. Select from courses in BIOL, BIOCH, BIOSC, CH, GEOL, MICRO, PHYS; or EN SP 200. At least one course must include a laboratory and satisfy the Natural Science General Education Requirement.
3. See General Education Requirements.
4. MTHSC 301, 302, or 309.
5. Select from School-approved list.
6. Select from 300-level or higher CP SC courses. No more than six credits of CP SC 481 may be used.
7. Select from MGT 390, 402, FIN 306.
8. Select from MGT 452, 454, 455, 456, or 400-level CP SC courses. CP SC 481 may not be used.

Sophomore Year
First Semester
3 - CP SC 207 Discrete Structures for Computing
4 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement
3 - Natural Science Requirement1
3 - Oral Communication Requirement2

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
3 - Probability and Statistics Requirement1
3 - Elective

COMPUTER SCIENCE

Bachelor of Science
The Computer Science program is oriented toward design, implementation, and application of software systems to solve information processing problems. Emphasis areas outside computer science allow students to tailor the program to their individual needs and interests. This program is more technically oriented than the Computer Information Systems curriculum. It prepares students for employment in the computer software field or for continued study toward an advanced degree in computer science. This program is accredited by the Computing Accreditation Commission (CAC) of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700. Additional information can be found at www.cs.clemson.edu.

Students who change majors into Computer Science must have earned a grade 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
1 - ENGL 101/103 Composition
4 - MTHSC 103 Calculus of One Variable I
4 - Natural Science Requirement1

Second Semester
4 - CP SC 102 Computer Science II
4 - MTHSC 108 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement2
4 - Natural Science Requirement1

Sophomore Year
First Semester
3 - CP SC 201 Computer Science I
3 - CP SC 210 Discrete Structures for Computing
4 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement
3 - Natural Science Requirement1
3 - Oral Communication Requirement2

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
3 - Probability and Statistics Requirement1
3 - Elective

1Two-semester sequence in the same physical or biological science, each including a laboratory, is required. Select from BIOL 103/105, 104/106, 110, 112; CH 101, 112; 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.
2See General Education Requirements.
3MTHSC 301, 302 or 309.
4Select from courses in A A H, ANTH, ART, CHIN, COMM, DANCE, E A S, ECON, ENGL, FR, GEOG, GER, HIST, HUM, ITAL, JAP, MUSIC, P A, P A S, PHIL, PO SC, PSYCH, REL, RUSS, SOC, SPAN, THEA, W S.
5Select 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.
6Select from School-approved list.

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 Requirement2

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 Requirement4 or
3 - Social Science Requirement4
3 - Social Science Requirement4

Senior Year
First Semester
3 - CP SC 352 Programming Languages
3 - Computer Science Requirement6
3 - Elective

Second Semester
3 - CP SC 491 Seminar in Professional Issues II
3 - Arts and Humanities Requirement4 or
3 - Social Science Requirement4
6 - Computer Science Requirement5
3 - Elective

122 Total Semester Hours
COMPUTER SCIENCE

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

Students who change majors into Computer Science must have a cumulative grade-point 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. Analysis1 and 1 - Elective1 or 4 - MTHSC 106 Calculus of One Variable I
4 - Foreign Language Requirement2
15

Second Semester
4 - CP SC 102 Computer Science II
3 - MTHSC 207 Multivariable Calculus3 and 1 - Elective1 or 4 - MTHSC 108 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Req.1
4 - Foreign Language Requirement2
15

Sophomore Year
First Semester
3 - CP SC 207 Discrete Structures for Computing
4 - CP SC 212 Algorithms and Data Structures
3 - Arts and Humanities (Literature) Requirement1
3 - Foreign Language Requirement2
3 - Oral Communication Requirement3
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
1 - Foreign Language Requirement2
1 - Natural Science Requirement4
15

Junior Year
First Semester
6 - Computer Science Requirement5
3 - Mathematical Sciences Requirement6
3 - Minor Requirement
3 - Natural Science Requirement4
15

Second Semester
3 - Computer Science Requirement5
6 - Minor Requirement
3 - Social Science Requirement1
3 - Writing Requirement7
15

Senior Year
First Semester
6 - Computer Science Requirement5
3 - Departmental Humanities Requirement8
3 - Minor Requirement
3 - Social Science Requirement1
15

Second Semester
3 - CP SC 491 Seminar in Professional Issues II
3 - Computer Science Requirement5
3 - Fine Arts Requirement9
3 - Minor Requirement
3 - Elective
15
121 Total Semester Hours

1Select 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.
2Four semesters (through 202) in the same modern foreign language are required.
3See General Education Requirements.
4Select from courses in BIOL, BIOCH, BIOSC, CH, GEO, MICRO, PHYS, or EN SP 200. At least one course must include a laboratory and satisfy the Natural Science General Education Requirement.
5Select from CP SC courses numbered 300 or higher. 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.
6MTHSC 301, 302, or 311; MTHSC 311 is required for all graphics courses.
7Select from Schoolapproved lists.
8Select from courses in A A H, ANTH, ART, CHIN, DANCE, ENGL, FRANC, HUM, ITAL, JAPN, MUSIC, P A, PHIL, REL, RUSS, SPAN, THEA.
9MUSIC 210 or any course in A A H, ART, or THEA

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

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

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

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

Second Semester
4 - CH 102 General Chemistry
4 - GEOL 102 Earth History
4 - GEOL 108 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement1
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 Geostatistics1
1 - GEOL 291 Introduction to Research I
1 - Elective
15

Second Semester
4 - CSENV 202 Soils
4 - GEOL 212 Geostatistics2
1 - GEOL 292 Introduction to Research II
3 - PHYS 122 Physics with Calculus I
3 - Social Science Requirement1
15
Junior Year
First Semester
3 - EN SP 200 Intro. to Environmental Science
4 - GEOL 302 Structural Geology
3 - GEOL 316 Igneous and Metamorphic Petrology
2 - GEOL 391 Research Methods I
3 - Arts and Humanities (Literature) Requirement
15
Second Semester
3 - GEOL 300 Environmental Geology
4 - GEOL 313 Sedimentology and Stratigraphy
2 - GEOL 392 Research Methods II
3 - Geology Requirement
2 - Elective
3 - Social Science Requirement
2 - Elective
17

Summer
6 - Summer Geology Field Course

Sophomore Year
First Semester
3 - BIOL 103 General Biology I
1 - BIOL 105 General Biology Lab. I
3 - GEOL 205 Mineralogy and Intro. Petrology
1 - GEOL 207 Mineral. and Intro. Petrology Lab.
4 - GEOL 211 Geoanalysis I
1 - GEOL 291 Introduction to Research I
3 - Arts and Humanities (Literature) Requirement
16
Second Semester
3 - BIOL 104 General Biology II
1 - BIOL 106 General Biology Lab. II
4 - GEOL 212 Geoanalysis II
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
2 - GEOL 391 Research Methods I
9 - Environmental Science Requirement
3 - Social Science Requirement
17
Second Semester
3 - GEOL 318 Introduction to Geochemistry
2 - GEOL 392 Research Methods II
9 - Environmental Science Requirement
3 - Social Science Requirement
17

Summer
3 - Field Experience

Senior Year
First Semester
3 - EN SP 400 Studies in Environmental Science
3 - GEOL 408 Geochemistry
3 - GEOL 491 Research Synthesis I
9 - Environmental Science Requirement
3 - Technical Requirement
12
Second Semester
3 - CH 223 Organic Chemistry or
3 - CH 413 Chemistry of Aqueous Systems
3 - GEOL 492 Research Synthesis II
6 - Environmental Science Requirement
12

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
15

Sophomore Year
First Semester
3 - GEOL 205 Mineralogy and Intro. Petrology
3 - GEOL 207 Mineral., and Intro. Petrology Lab.
4 - GEOL 211 Geoanalysis I
1 - GEOL 291 Introduction to Research I
3 - Arts and Humanities (Literature) Requirement
16
Second Semester
4 - GEOL 212 Geoanalysis II
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
2 - GEOL 391 Research Methods I
9 - Environmental Science Requirement
3 - Technical Requirement
12
Second Semester
4 - GEOL 313 Sedimentology and Stratigraphy
3 - GEOL 318 Introduction to Geochemistry
2 - GEOL 392 Research Methods II
3 - Social Science Requirement
3 - Technical Requirement
15

Summer
6 - GEOL 475 Summer Geology Field Camp

Senior Year
First Semester
3 - GEOL 421 GIS Applications in Geology
3 - GEOL 491 Research Synthesis I
3 - Geology Requirement
3 - Technical Requirement
12
SECOND SEMESTER
3 - EE&S 401 Environmental Engineering
4 - GEOL 409 Subsurface Methods
3 - GEOL 492 Research Synthesis II
3 - Technical Requirement

121 Total Semester Hours

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

†MTHSC 206 and 208 or 301 or EX ST 301 may be substituted.
†Select from department approved list.
*Any 300- or 400-level geology course

GEOLGY
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

14

SECOND SEMESTER
4 - CH 102 General Chemistry
3 - GEOG 103 World Regional Geography
4 - GEOL 102 Earth History
3 - Mathematics Requirement
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
3 - Foreign Language Requirement

16

SECOND SEMESTER
3 - BIOL 104 General Biology II
1 - BIOL 106 General Biology Lab. II
1 - GEOL 292 Introduction to Research II
3 - GEOL 300 Environmental Geology
4 - Foreign Language Requirement
3 - Minor Requirement

15

JUNIOR YEAR
First Semester
2 - GEOL 391 Research Methods I
3 - Foreign Language Requirement
3 - Geology Requirement
3 - Minor Requirement
3 - Social Science Requirement
3 - Technical Requirement

17

SECOND SEMESTER
2 - GEOL 392 Research Methods II
3 - Foreign Language Requirement
3 - Geology Requirement
3 - Minor Requirement
6 - Elective

17

SENIOR YEAR
First Semester
3 - GEOL 491 Research Synthesis I
3 - Arts and Humanities (Literature) Requirement
3 - Minor Requirement
3 - Elective

12

SECOND SEMESTER
3 - GEOL 492 Research Synthesis II
3 - Minor Requirement
3 - Technical Requirement
6 - Elective

15

122 Total Semester Hours

†MTHSC 106 and 108 are recommended; however, MTHSC 101 and 102 or MTHSC 102 and 203 may be substituted.
†Spanish is recommended. Two years (through 202) in the same foreign language are required.
†See advisor.
*Any 300- or 400-level geology course

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 the necessary mathematical skills, the curriculum allows students to select an emphasis area or concentration, providing an introduction to a specific area where mathematics is used. These are Abstract Mathematics, Actuarial Science/Financial Mathematics, Applied and Computational Mathematics, Biology, Computer Science, Operations Research/Management Science, and Statistics.

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

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

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

Senior Year
First Semester
3 - COMM 250 Public Speaking
3 - Capstone Experience
6 - Emphasis Area Requirement
3 - Science and Tech. in Society Requirement

15

Second Semester
1 - MTHSC 492 Professional Development
3 - Capstone Experience
3 - Emphasis Area Requirement
3 - Mathematical Sciences Requirement
3 - Elective

13

Total Semester Hours
122

Notes:

1. See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Requirement.
2. Three credits in any foreign language, including American Sign Language, numbered 102 or above.
3. CP SC 101, 111, or 120
4. 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
5. ECON 314 and 405; CP SC 102 and 212; CP SC 210 and 212; or any two natural science courses from General Education Natural Science Requirements (labs not required). 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.
7. 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.
8. Any 400-level MTHSC course approved by advisor.

EMPHASIS AREAS

Abstract Mathematics
6 - Abstract Mathematics Requirement
6 - Mathematical Sciences Requirement

12

Actuarial Science/Financial Mathematics
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

12

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

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

Second Semester

BIOLOGY CONCENTRATION

Freshman Year
First Semester
5 - BIOL 110 Principles of Biology I
3 - ENGL 103 Accelerated Composition
4 - MTHSC 136 Calculus of One Variable I
3 - Foreign Language Requirement

15

Second Semester
5 - BIOL 111 Principles of Biology II
4 - MTHSC 136 Calculus of One Variable II
3 - Computer Science Requirement

15

Sophomore Year
First Semester
4 - CH 101 General Chemistry
3 - ECON 211 Principles of Microeconomics or 3 - ECON 211 Principles of Microeconomics
4 - MTHSC 206 Calculus of Several Variables
3 - 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
3 - 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

16

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

16

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

15

Second Semester

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

15

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

16

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

15

Second Semester

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.

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

Second Semester

BIOLOGY CONCENTRATION

Freshman Year
First Semester
5 - BIOL 110 Principles of Biology I
3 - ENGL 103...
Sophomore Year

<table>
<thead>
<tr>
<th>First Semester</th>
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<tbody>
<tr>
<td>1. MTHSC 206 Calculus of Several Variables</td>
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<tr>
<td>2. MTHSC 250 Intro. to Mathematical Sciences</td>
</tr>
<tr>
<td>4. EDSEC 437 Technology in Sec. Math.</td>
</tr>
<tr>
<td>5. Arts and Humanities (Literature) Requirement</td>
</tr>
<tr>
<td>6. Elective</td>
</tr>
<tr>
<td><strong>Total Semester Hours:</strong> 16</td>
</tr>
</tbody>
</table>

Second Semester

| 4. MTHSC 208 Intro. to Ordinary Diff. Equations |
| 3. MTHSC 311 Linear Algebra |
| 3. Arts and Humanities (Non-Lit.) Requirement |
| 3. Minor Requirement or 5. Second Major Requirement |
| **Total Semester Hours:** 16 |

Junior Year

First Semester

| 3. ENGL 314 Technical Writing |
| 3. MTHSC 412 Introduction to Modern Algebra |
| 3. Math Science Requirement |
| 4. Natural Science Requirement |
| 3. Elective |
| **Total Semester Hours:** 16 |

Second Semester

| 3. COMM 250 Public Speaking |
| 3. Math Science Requirement |
| 3. Minor Requirement or 5. Second Major Requirement |
| 4. Natural Science Requirement |
| 3. Elective |
| **Total Semester Hours:** 16 |

Senior Year

First Semester

| 3. MTHSC 453 Advanced Calculus I |
| 3. Arts and Humanities Requirement or 5. Education Requirement |
| 3. Capstone Experience |
| 3. Minor Requirement or 5. Second Major Requirement |
| 3. Science and Tech. in Society Requirement |
| **Total Semester Hours:** 15 |

Second Semester

| 1. MTHSC 492 Professional Development |
| 3. Capstone Experience |
| 3. Math Science Requirement |
| 2. Elective |
| **Total Semester Hours:** 15 |

**122 Total Semester Hours**

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

Freshman Year

<table>
<thead>
<tr>
<th>First Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PHYS 101 Current Topics in Modern Physics</td>
</tr>
<tr>
<td>2. PHYS 102 Physics Lab. I</td>
</tr>
<tr>
<td>2. Arts and Humanities (Non-Lit.) Requirement</td>
</tr>
<tr>
<td><strong>Total Semester Hours:</strong> 15</td>
</tr>
</tbody>
</table>

Second Semester

| 1. PHYS 122 Physics with Calculus I |
| 4. CH 101 General Chemistry |
| 3. ENGL 103 Accelerated Composition |
| 4. MTHSC 106 Calculus of One Variable I |
| 1. PHYS 102 Physics Lab. II |
| **Total Semester Hours:** 15 |

Sophomore Year

<table>
<thead>
<tr>
<th>First Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. MTHSC 206 Calculus of Several Variables</td>
</tr>
<tr>
<td>3. PHYS 221 Physics with Calculus II</td>
</tr>
<tr>
<td>1. PHYS 223 Physics Lab. II</td>
</tr>
<tr>
<td>4. Foreign Language Requirement</td>
</tr>
<tr>
<td>3. Oral Communication Requirement</td>
</tr>
<tr>
<td><strong>Total Semester Hours:</strong> 15</td>
</tr>
</tbody>
</table>

Second Semester

| 4. MTHSC 208 Intro. to Ordinary Diff. Equations |
| 3. PHYS 222 Physics with Calculus III |
| 1. PHYS 224 Physics Lab. III |
| 4. Foreign Language Requirement |
| 3. Social Science Requirement |
| **Total Semester Hours:** 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. Emphasis Area Requirement |
| 3. Physics Writing Requirement |
| **Total Semester Hours:** 15 |

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 |
| 3. PHYS 356 Modern Physics Overview |
| 3. PHYS 441 Electromagnetics I |
| 3. Emphasis Area Requirement |
| **Total Semester Hours:** 15 |

Senior Year

First Semester

| 3. PHYS 401 Senior Thesis |
| 3. PHYS 442 Electromagnetics II |
| 3. PHYS 455 Quantum Physics I |
| 3. Emphasis Area Requirement |
| 3. Science Requirement |
| **Total Semester Hours:** 15 |

Second Semester

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

**122 Total Semester Hours**

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

3Two semesters (through 102) in the same modern foreign language are required.

*See advisor. Select from the following emphasis areas: Chemistry, Computer Science, Engineering, Environmental Engineering, Geology, Mathematical Sciences, or Physics and Astronomy. Twelve credit hours in one of these areas, with at least six at the 300-400 level, are required. Note: Requirements for a minor in one of these areas might be satisfied with three additional credits at the 300-400 level.

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

*Any 200-400 level science course

*Select any ENGL course from General Education Arts and Humanities (Literature) Requirement.
BIOPHYSICS CONCENTRATION
The Biophysics Concentration offers an excellent preparation for medical school or graduate work in biological sciences. It includes the flexibility of selecting courses in chemistry, biological sciences, physics, and mathematics. This concentration also provides the necessary background for employment in industry, manufacturing, and instrumentation for clinical or molecular biology applications.

Freshman Year
First Semester
3 - ASTR 105 Physics of the Universe
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
1 - PHYS 101 Current Topics in Modern Physics
15
Second Semester
4 - CH 102 General Chemistry
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. I
3 - Arts and Humanities (Non-Lit.) Requirement
15
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
16
Second Semester
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
3 - PHYS 222 Physics with Calculus III
1 - PHYS 224 Physics Lab. III
4 - Biophysics Requirement
3 - Social Science Requirement
15
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
3 - Physics Writing Requirement
4 - Minor Requirement
15
Second Semester
3 - PHYS 321 Mechanics I
3 - PHYS 325 Experimental Physics I
2 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.
2 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
15
Second Semester
4 - CH 102 General Chemistry
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. I
3 - Arts and Humanities (Non-Lit.) Requirement
15

Sophomore Year
First Semester
3 - PHYS 442 Electromagnetics II
3 - PHYS 455 Quantum Physics I
3 - Biophysics Requirement
3 - Physics Writing Requirement
3 - Science Requirement
15
Second Semester
3 - PHYS 465 Thermodynamics and Statistical Mechanics
3 - Arts and Humanities (Literature) Requirement
3 - Biophysics Requirement
125 Total Semester Hours
3 See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.
3 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.
3 Select any ENGL course from General Education Arts and Humanities (Literature) Requirement.

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MINORS

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

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

See pages 37–40 for details.