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:

- apply knowledge of math, science, and engineering
- identify, formulate, and solve engineering problems
- design and conduct experiments and analyze data
- design systems or components to meet needs within realistic constraints
- function on multidisciplinary teams
- communicate effectively
- conduct themselves professionally and ethically
- understand engineering’s global, economic, environmental, and societal context
- understand contemporary engineering issues
- apply modern engineering methods and tools
- appreciate the need for lifelong learning

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

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

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

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

Freshman Curriculum
First Semester

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

Second Semester

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

16

Elective Credit

3 - PHYS 122 Physics with Calculus I
2-3 - Departmental Freshman Engineering Req.

3 - PHYS 122 Physics with Calculus I
3 - Departmental Science Requirement

15-17

(See Policy on General Education Requirements for Engineering Curricula below).

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

1. CES 102 Engineering Disciplines and Skills
2. CH 101 General Chemistry
3. ENGL 103 Accelerated Composition
4. MTHSC 106 Calculus of One Variable I
5. MTHSC 108 Calculus of One Variable II
6. PHYS 122 Physics with Calculus I
7. 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 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
1 - BIO E 201 Intro. to Biomedical Engineering
2 - E C E 201 Logic and Computing Devices
3 - E C E 202 Electric Circuits I
4 - E C E 211 Electrical Engineering Lab. I
15
Second Semester
1 - E C E 212 Electrical Engineering Lab. II
2 - E C E 262 Electric Circuits II
3 - MS&E 210 Introduction to Materials Science
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
17
Sophomore Year
First Semester
1 - BIO E 302 Biomaterials
2 - BIO E 370 Bioinstrumentation and Biimaging
3 - BIOCH 305 Essential Elements of Biochem.
4 - MS&E 210 Introduction to Materials Science
12
Second Semester
1 - BIO E 309 Bioengineering Design Theory
2 - BIOSC 315 Functional Human Anatomy
3 - BIOSC 461 Cell Biology
4 - BIOSC 462 Cell Biology Lab.
15
Senior Year
First Semester
1 - BIO E 320 Biomcehanics
2 - BIO E 401 Bioengineering Design Theory
3 - BIO E 403 Applied Biomedical Design
4 - BIO E 448 Tissue Engineering
6 - Bioengineering or E C E Technical Requirement
16
128 Total Semester Hours

Biomaterials Concentration
Freshman Year
First Semester
1 - CES 102 Engineering Disciplines and Skills
2 - CH 101 General Chemistry
3 - ENGR 141 Programming and Problem Solving
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
16
Second Semester
1 - CH 201 Survey of Organic Chemistry
2 - E C E 211 Electrical Engineering Lab. III
3 - E C E 320 Electronics I
4 - E C E 330 Signals, Systems, and Transforms
3 - Social Science Requirement
17
Second Semester
1 - BIO E 302 Biomaterials
2 - BIO E 370 Bioinstrumentation and Biimaging
3 - BIOCH 305 Essential Elements of Biochem.
4 - MS&E 210 Introduction to Materials Science
12
Second Semester
1 - BIO E 320 Biomcehanics
2 - BIO E 401 Bioengineering Design Theory
3 - BIO E 403 Applied Biomedical Design
4 - BIO E 448 Tissue Engineering
6 - Bioengineering or E C E Technical Requirement
16
128 Total Semester Hours

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

BIOMATERIALS CONCENTRATION
Freshman Year
First Semester
1 - CES 102 Engineering Disciplines and Skills
2 - CH 101 General Chemistry
3 - ENGR 141 Programming and Problem Solving
4 - MTHSC 106 Calculus of One Variable I
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
16
Second Semester
1 - CH 102 General Chemistry
2 - ENGR 141 Programming and Problem Solving
3 - MTHSC 108 Calculus of One Variable II
4 - PHYS 122 Physics with Calculus I
3 - Social Science Requirement
17
Second Semester
1 - BIO E 302 Biomaterials
2 - BIO E 370 Bioinstrumentation and Biimaging
3 - BIOCH 305 Essential Elements of Biochem.
4 - MS&E 210 Introduction to Materials Science
12
Second Semester
1 - BIO E 320 Biomcehanics
2 - BIO E 401 Bioengineering Design Theory
3 - BIO E 403 Applied Biomedical Design
4 - BIO E 448 Tissue Engineering
6 - Bioengineering or E C E Technical Requirement
16
128 Total Semester Hours
Junior Year
First Semester
3 - BIO E 320 Biomechanics
4 - BIOSC 315 Functional Human Anatomy
3 - MS&E 319 Materials Processing I
3 - MS&E 326 Thermodynamics of Materials
3 - MS&E 327 Transport Phenomena
16
Second Semester
3 - BIOCH 305 Essential Elements of Biochem.
3 - BIO E 321 Bioinstrumentation and Bioimaging
3 - BIO E 370 Bioinstrumentation and Bioimaging
15

Senior Year
First Semester
3 - BIO E 370 Bioinstrumentation and Bioimaging
3 - BIO E 401 Bioengineering Design Theory
3 - BIOSC 461 Cell Biology
3 - MS&E 415 Intro. to Polymer Science and Engr.
3 - Bioengineering Technical Requirement 4
3 - Social Science Requirement 4
15
Second Semester
1 - BIO E 400 Senior Seminar
3 - BIO E 403 Applied Biomedical Design
3 - BIO E 448 Tissue Engineering
6 - Arts and Humanities Requirement 4 or Social Science Requirement 4
3 - Bioengineering Technical Requirement 4
16
128 Total Semester Hours

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

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

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 the Cooperative Education, Biosystems Engineering Intern, and/or Study Abroad Programs. Those interested in medical careers should consider graduate study and/or medical school.

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

Combined Bachelor’s/Master’s Program
Under this plan, students may reduce the time necessary to earn both degrees by applying graduate credits to both undergraduate and graduate program requirements.

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

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

Freshman Year
First Semester
2 - C E 210 Intro. to Biosystems Engineering
3 - C E 201 Statics
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
2 - E C E 307 Basic Electrical Engineering
3 - CH 102 General Chemistry
16-17
Second Semester
2 - B E 212 Fundamentals of Biosystems Engr.
2 - C E 208 Dynamics
2 - B E 210 Intro. to Biosystems Engineering
3 - M E 310 Thermodynamics and Heat Transfer or
3 - CH E 220 Chem. Engr. Thermodynamics I
4 - MICRO 305 General Microbiology
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
17
Sophomore Year
First Semester
2 - B E 222 Geomeasurements
3 - B E 410 Biol. Kinetics and Reactor Modeling
3 - CH 223 Organic Chemistry
1 - CH 227 Organic Chemistry Laboratory
2 - C E 307 Basic Electrical Engineering
3 - Mechanics of Materials Requirement 4
3 - Arts and Humanities Requirement 4 or Social Science Requirement 4
17
Second Semester
3 - B E 322 Small Watershed Hydrology and Sedimentology
3 - B E 412 Heat and Mass Transport in B E
4 - B E 415 Instrumentation and Control for Biosystems Engineers
3 - B E 438 Bioprocess Engineering Design
4 - C E 341 Introduction to Fluid Mechanics
17

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

M E 201 may be substituted for C E 201 and 208
Biol 103/105 or 110
C E 206 or M E 302
BIOPROCESS ENGINEERING
EMPHASIS AREA

Senior Year

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

Second Semester
- B E 475 Biosystems Engr. Capstone Design
- Engineering Requirement\(2\)
- Life Science Requirement\(3\)
- Arts and Humanities Requirement\(3\) or
- Social Science Requirement\(3\)
- 14

129 Total Semester Hours

Notes:
1. Biosystems Engineering students are allowed to enroll in all upper level B E courses only when the following prerequisites have been completed with a C or better: C E 201, 206, 206, 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.

ECOLOGICAL ENGINEERING
EMPHASIS AREA

Senior Year

First Semester
- B E 474 Biosystems Engr. Design/Project Mgt.
- BIOCH 441 Ecology
- Ecological Requirement\(3\)
- Engineering Requirement\(2\)
- Arts and Humanities Requirement\(2\) or
- Social Science Requirement\(3\)
- 14

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

129 Total Semester Hours

Notes:
1. See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.
2. B E 34, 408, 414, 417, 422, 440, 464, 473, 484, C E 321, 352, 402, 406, 462, EES&S 401, 402, 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 60-level instead of 400-level courses for Engineering Requirements.
3. Any BIOCH, BIOSC, BIOL, CH, CSENV, GEN, MICRO or W F B course at the 300 level or higher.

CHEMICAL ENGINEERING

Bachelor of Science

The Department of Chemical and Biomolecular Engineering offers the Bachelor of Science degree in Chemical Engineering. Chemical Engineering students select one of several emphasis areas (such as energy studies or environmental engineering), or 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 technical and/or managerial leadership contributions;
• ethical 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 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
- B E 102 Engineering Disciplines and Skills
- CH 101 General Chemistry
- ENGL 103 Accelerated Composition
- MTHSC 106 Calculus of One Variable I
- Arts and Humanities Requirement\(2\) or
- Social Science Requirement\(3\)
- 16

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

Sophomore Year

First Semester
- CH 223 Organic Chemistry
- CH 229 Organic Chemistry Lab.
- CH 220 Chemical Engr. Thermodynamics I
- CH 230 Fluids/Heat Transfer
- MTHSC 208 Intro. to Ordinary Diff. Equations
- 15

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

Junior Year

First Semester
- BIOCH 305 Essential Elements of Biochem.
- CH 339 Physical Chemistry Lab.
- CH 307 Unit Operations Lab. I
- CH 319 Engineering Materials
- E C E 307 Basic Electrical Engineering
- E C E 309 Electrical Engineering Lab. I
- EX ST 411 Statistical Methods for Process Development and Control
- 16

Notes:
1. See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.
Second Semester
3 - CH 332 Physical Chemistry
1 - CH 340 Physical Chemistry Lab.
3 - CH E 321 Chemical Engr. Thermodynamics II
4 - CH E 330 Mass Transfer and Separation Proc.
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
3 - Emphasis Area Requirement

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

Second Semester
3 - CH E 353 Process Dynamics and Control
3 - CH E 444 Chemical Engr. Senior Seminar II
3 - MICRO 413 Industrial Microbiology
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
3 - Emphasis Area Requirement

16
129 Total Semester Hours

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

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

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 Requirement or
3 - Social Science Requirement
16

Sophomore Year
First Semester
5 - BIOL 110 Principles of Biology I
3 - CH 223 Organic Chemistry
4 - CH E 211 Intro. to Chemical Engineering
4 - MTHSC 206 Calculus of Several Variables
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
19

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

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

Second Semester
3 - BIO E 302 Biomaterials
3 - BMOLE 425 Biomolecular Engineering
3 - CH E 321 Chemical Engr. Thermodynamics II
4 - CH E 330 Mass Transfer and Separation Proc.
3 - PHYS 221 Physics with Calculus II

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

Second Semester
3 - CH E 353 Process Dynamics and Control
3 - CH E 444 Chemical Engr. Senior Seminar II
6 - Arts and Humanities Requirement or
6 - Social Science Requirement
3 - Engineering Requirement

16
131 Total Semester Hours

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

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

Second Semester
2 - ENGR 130 Engineering Fundamentals
3 - GEOL 101 Physical Geology
1 - GEOL 103 Physical Geology Lab.
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
1 - PHYS 124 Physics Lab. I
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
17
Sophomore Year
First Semester
3 - C E 201 Statics
2 - E G 210 Intro. to Engr./Computer Graphics
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
1 - PHYS 223 Physics Lab. II
3 - Arts and Humanities Requirement1 or
   3 - Social Science Requirement1
16

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

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

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

Senior Year
First Semester
3 - ENGL 314 Technical Writing
3 - Design Technical Requirement2
6 - Technical Requirement1
3 - Technical Requirement Restricted1
15

Second Semester
3 - C E 459 Capstone Design Project
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Arts and Humanities (Literature) Requirement1 or
3 - Technical Requirement1
3 - Elective
15

128 Total Semester Hours

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

2See advisor for approved list.

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

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

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

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

Second Semester
3 - ENGR 141 Programming and Problem Solving
4 - MTHSC 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
6 - Arts and Humanities Requirement1 or
   6 - Social Science Requirement1
16

Sophomore Year
First Semester
3 - CP SC 111 Elementary Computer Programming in C/C++
3 - E C E 201 Logic and Computing Devices
3 - E C E 202 Electric Circuits I
1 - E C E 209 Logic and Computing Devices Lab.
1 - E C E 211 Electrical Engineering Lab. I
4 - MTHSC 206 Calculus of Several Variables
3 - PHYS 221 Physics with Calculus II
17

Second Semester
1 - E C E 212 Electrical Engineering Lab. II
3 - E C E 222 Systems Programming Concepts for Computer Engineering
3 - E C E 262 Electric Circuits II
3 - E C E 272 Computer Organization
1 - E C E 273 Computer Organization Laboratory
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
15

Junior Year
First Semester
3 - E C E 223 Computer Systems Engineering
1 - E C E 311 Electrical Engineering Lab. III
3 - E C E 320 Electronics I
3 - E C E 330 Signals, Systems, and Transforms
3 - E C E 371 Microcontroller Interfacing
1 - E C E 372 Microcontroller Interfacing Lab.
3 - MTHSC 311 Linear Algebra
17

Second Semester
3 - E C E 317 Random Signal Analysis
3 - E C E (CP SC) 322 Intro. to Operating Systems
3 - E C E 327 Digital Computer Design
3 - E C E 352 Programming Systems
3 - MTHSC 419 Discrete Math. Structures I
15

Senior Year
First Semester
3 - COMM 150 Intro. to Human Comm. or
   3 - COMM 250 Public Speaking
3 - E C E 409 Continuous and Discrete Sys. Design
2 - E C E 495 Integrated System Design I
3 - ENGL 314 Technical Writing
6 - Computer Engineering Technical Requirement2
17

Second Semester
2 - E C E 496 Integrated System Design II
3 - Arts and Humanities (Literature) Requirement1
3 - Computer Engineering Technical Requirement2
3 - Computer Engineering Technical Depth Req.3
3 - Special Requirement4
14

127 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.

2Select from department-approved list.

3Select from ENGL 202, 210, 211, 212, 213, 214, or 215.

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

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

93
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.

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. E C E 201 Logic and Computing Devices
2. E C E 202 Electric Circuits I
4. E C E 211 Electrical Engineering Lab. I
5. MTHSC 206 Calculus of Several Variables
6. PHYS 221 Physics with Calculus II
7. Arts and Humanities Requirement
   or
8. Social Science Requirement
   —
   16

Second Semester
1. E C E 212 Electrical Engineering Lab. II
2. E C E 262 Electric Circuits II
3. E C E 272 Computer Organization
4. E C E 273 Computer Organization Laboratory
5. MTHSC 208 Intro. to Ordinary Diff. Equations
6. Arts and Humanities Requirement or
   - Social Science Requirement
   —
   15

Junior Year
First Semester
1. E C E 311 Electrical Engineering Lab. III
2. E C E 320 Electronics I
3. E C E 330 Signals, Systems, and Transforms
4. E C E 360 Electric Power Engineering
5. E C E 380 Electromagnetics
6. Advanced Mathematics Requirement
   —
   16

Second Semester
1. E C E 312 Electrical Engineering Lab. IV
2. E C E 317 Random Signal Analysis
3. E C E 321 Electronics II
4. E C E 371 Microcontroller Interfacing
5. E C E 372 Microcontroller Interfacing Lab.
6. E C E 381 Fields, Waves, and Circuits
7. ENGL 314 Technical Writing
   —
   17

Senior Year
First Semester
1. COMM 150 Intro. to Human Comm. or
   - COMM 250 Public Speaking
2. E C E 409 Continuous and Discrete Syst. Des.
3. E C E 427 Communications Systems
4. E C E 495 Integrated Systems Design I
5. Electrical Engineering Technical Req. 1
   —
   14

Second Semester
2. E C E 496 Integrated System Design II
3. Arts and Humanities Requirement
   or
4. Social Science Requirement
5. Arts and Humanities Requirement
   or
6. Social Science Requirement
   or
8. Electrical Engineering Technical Depth Req. 1
9. Special Requirement
   —
   14

126 Total Semester Hours

Second Semester
1. Arts and Humanities Requirement or
2. Social Science Requirement
   —
   16

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

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

Sophomore Year
First Semester
1. CP SC 111 Elementary Computer Programming in C/C++
2. E C E 201 Logic and Computing Devices
3. E C E 202 Electric Circuits I
5. E C E 211 Electrical Engineering Lab. I
6. MTHSC 206 Calculus of Several Variables
7. PHYS 221 Physics with Calculus II
   —
   17

Second Semester
1. E C E 311 Electrical Engineering Lab. III
2. E C E 320 Electronics I
3. E C E 330 Signals, Systems, and Transforms
4. E C E 360 Electric Power Engineering
5. E C E 380 Electromagnetics
6. Advanced Mathematics Requirement
   —
   16

Second Semester
1. Arts and Humanities Requirement or
2. Social Science Requirement
   —
   16

Three additional credits of approved Arts and Humanities or Social Science courses; or E L E 301 or 401; or any additional three-credit, 400-level course from the departmental Computer Engineering Technical Requirement list or Electrical Engineering Technical Requirement list; or one additional course selected from MTHSC 311, 412, 419, 454, 435, 440, 441, or 453.
Sophomore Year

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

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

Junior Year

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

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

Senior Year

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

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

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

**Second Semester**
- ENGR 141 Programming and Problem Solving
- MTHSC 108 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- Arts and Humanities Requirement\(^1\) or Social Science Requirement\(^2\)
- Lab Science Requirement\(^2\)

**Sophomore Year**

**First Semester**
- I E 200 Sophomore Seminar in I E
- I E 201 System Design I
- I E 280 Methods of Operational Research I
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- I E 208 Systems Design II

**Second Semester**
- C E 201 Statics
- E G 208 Engineering Graphics with Computer Applications
- E G 209 Introduction to Engineering/Computer Graphics
- I E 210 Design and Analysis of Work Systems
- I E 384 Engineering Economic Analysis
- MS&E 210 Introduction to Materials Science
- Arts and Humanities Requirement\(^1\) or Social Science Requirement\(^2\)

**Junior Year**

**First Semester**
- C E 208 Dynamics
- I E 360 Design and Control of Industrial Sys. I
- I E 368 Professional Practice in I E
- I E 440 Decision Support Systems in I E
- Arts and Humanities Requirement\(^1\) or Social Science Requirement\(^2\)
- Mathematics or Natural Science Req.\(^2\)

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

**Senior Year**

**First Semester**
- I E 461 Quality Engineering
- I E 465 Facilities Planning and Design
- I E 482 Systems Modeling
- Engineering Requirement\(^2\)
- Technical Requirement\(^2\)

**Second Semester**
- I E 467 Systems Design II
- Arts and Humanities Requirement\(^1\) or Social Science Requirement\(^2\)
- Management Requirement\(^2\)
- Technical Requirement\(^2\)

**Inorganic 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 Requirement\(^1\) or Social Science Requirement\(^2\)

**Second Semester**
- CH 101 General Chemistry
- CES 102 Engineering Disciplines and Skills
- MTHSC 108 Calculus of One Variable II
- PHYS 122 Physics with Calculus I
- Arts and Humanities Requirement\(^1\) or Social Science Requirement\(^2\)

**Sophomore Year**

**First Semester**
- CH 201 Survey of Organic Chemistry
- MS&E 210 Introduction to Materials Science
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- Arts and Humanities Requirement\(^1\) or Social Science Requirement\(^2\)
Second Semester
1. MTHSC 106 Calculus of One Variable I 3
2. ENGL 103 Accelerated Composition 3
3. CH 101 General Chemistry 4
4. MTHSC 108 Calculus of One Variable II 4
5. PHYS 122 Physics with Calculus I 3
6. Arts and Humanities Requirement or Social Science Requirement or both 3

16 Total Semester Hours

Junior Year
First Semester
1. MS&E 241 Metrics Laboratory 1
2. MS&E 319 Materials Processing I 3
3. MS&E 326 Thermodynamics of Materials 3
4. MS&E 327 Transport Phenomena 3
5. MS&E 415 Intro. to Polymer Sci. and Engr. 3
6. MTHSC 302 Statistics for Science and Engr. 3

Second Semester
1. I E 384 Engineering Economic Analysis 3
2. MS&E 328 Phase Diagrams for Metals and Their Composites 3
3. MS&E 422 Mechanical Behavior of Materials 3
4. EX ST 301 Introductory Statistics or MTHSC 302 Statistics for Science and Engr. 3

Senior Year
First Semester
1. MS&E 302 Solid State Materials 3
2. MS&E 413 Noncrystalline Materials 3
3. MS&E 432 Manufacturing Processes and Sys. 3
4. MS&E 441 Manufacturing Laboratory 3
5. MS&E 491 Undergraduate Research 3

Second Semester
1. MS&E 407 Senior Capstone Design 3
2. MS&E 416 Electrical Properties of Materials 3
3. MS&E 424 Optical Materials and Applications 3
4. MS&E 433 Combustion System and Environmental Emissions 3
5. MS&E 445 Practice of Materials Engineering 3

124 Total Semester Hours

See Policy on Humanities and Social Sciences for Engineering General Education requirements.

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

Second Semester
1. MS&E 407 Senior Capstone Design 3
2. MS&E 445 Practice of Materials Engineering 3
3. MS&E 457 Color Science 3
4. MS&E 459 Color Science Laboratory 3
5. Arts and Humanities Requirement or Social Science Requirement 3

14 Total Semester Hours

Junior Year
First Semester
1. MS&E 302 Solid State Materials 3
2. MS&E 413 Noncrystalline Materials 3
3. MS&E 432 Manufacturing Processes and Sys. 3
4. MS&E 441 Manufacturing Laboratory 3
5. MS&E 491 Undergraduate Research 3

Second Semester
1. MS&E 407 Senior Capstone Design 3
2. MS&E 416 Electrical Properties of Materials 3
3. MS&E 424 Optical Materials and Applications 3
4. MS&E 433 Combustion System and Environmental Emissions 3
5. MS&E 445 Practice of Materials Engineering 3

16 Total Semester Hours

Senior Year
First Semester
1. MS&E 458 Surface Phenomena in Materials Science and Engineering 3
2. MS&E 460 Surface Phenomena in Materials Science and Engineering Laboratory 3
3. MS&E 461 Polymer and Fiber Science I 3
4. MS&E 491 Undergraduate Research 3

Second Semester
1. MS&E 407 Senior Capstone Design 3
2. MS&E 445 Practice of Materials Engineering 3
3. MS&E 457 Color Science 3
4. MS&E 459 Color Science Laboratory 3
5. Arts and Humanities Requirement or Social Science Requirement 3

14 Total Semester Hours

See Policy on Humanities and Social Sciences for Engineering General Education requirements.

MECHANICAL ENGINEERING
Bachelor of Science

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 (EGFR) 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 EGFR 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.
### Freshman Year

**First Semester**
- 2 - CES 102 Engineering Disciplines and Skills
- 4 - CH 101 General Chemistry
- 3 - ENGR 141 Programming and Problem Solving
- 3 - MTHSC 106 Calculus of One Variable I
- 3 - Arts and Humanities Requirement or
- 3 - Social Science Requirement

**Second Semester**
- 2 - E 208 Engineering Graphics with Computer Applications
- 3 - ENGR 11 Statics and Dynamics for Mech. Engrs.
- 4 - PHYS 122 Physics with Calculus I
- 1 - PHYS 124 Physics Lab. I
- 3 - Arts and Humanities Requirement or
- 3 - Social Science Requirement

### Sophomore Year

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

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

### Junior Year

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

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

### Senior Year

**First Semester**
- 3 - M 312 Manufacturing Processes and Their Application
- 3 - M 401 Mechanical Engineering Design
- 3 - M 444 Mechanical Engineering Lab. III or
- 3 - Arts and Humanities Requirement or
- 3 - Social Science Requirement
- 6 - Technical Requirement

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

### 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.

#### SCIENCE PROGRAMS

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

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

#### 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.
### Chemstry

**Bachelor of Arts**

#### Freshman Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
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<tbody>
<tr>
<td>First Semester</td>
<td>4 - CH 101 General Chemistry</td>
</tr>
<tr>
<td></td>
<td>1 - CH 141 Chemistry Orientation</td>
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<td></td>
<td>3 - ENGL 103 Accelerated Composition</td>
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<td></td>
<td>4 - MTHSC 106 Calculus of One Variable I</td>
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<td></td>
<td>3 - Arts and Humanities Requirement/ Social Science Requirement</td>
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<tr>
<td>Second Semester</td>
<td>4 - CH 102 General Chemistry</td>
</tr>
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<td></td>
<td>2 - CH 152 Chemistry Communication I</td>
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<td></td>
<td>4 - MTHSC 108 Calculus of One Variable II</td>
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<td>3 - PHYS 122 Physics with Calculus I</td>
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<td></td>
<td>3 - Arts and Humanities Requirement/ Social Science Requirement</td>
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**Sophomore Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
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<tbody>
<tr>
<td>First Semester</td>
<td>3 - CH 223 Organic Chemistry</td>
</tr>
<tr>
<td></td>
<td>1 - CH 227 Organic Chemistry Lab.</td>
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<tr>
<td></td>
<td>4 - MTHSC 206 Calculus of Several Variables</td>
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<td>3 - PHYS 221 Physics with Calculus II</td>
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<td>1 - PHYS 223 Physics Lab.</td>
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<td>15</td>
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<tr>
<td>Second Semester</td>
<td>3 - CH 205 Introduction to Inorganic Chemistry</td>
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<td>3 - CH 224 Organic Chemistry</td>
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<td>1 - CH 228 Organic Chemistry Lab.</td>
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<td>4 - MTHSC 208 Intro. to Ordinary Diff. Equations</td>
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<tr>
<td></td>
<td>3 - PHYS 222 Physics with Calculus III</td>
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<td></td>
<td>1 - PHYS 224 Physics Lab.</td>
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#### Junior Year

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<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
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<tbody>
<tr>
<td>First Semester</td>
<td>3 - BIOC 301 Molecular Biochemistry or</td>
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<td>3 - BIOC 305 Essential Elements of Bioch.</td>
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<td>3 - CH 313 Quantitative Analysis</td>
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<td>2 - CH 315 Quantitative Analysis Lab.</td>
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<td>3 - CH 331 Physical Chemistry</td>
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<td>1 - CH 339 Physical Chemistry Lab.</td>
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<td>3 - ENGL 314 Technical Writing</td>
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<td>15</td>
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<tr>
<td>Second Semester</td>
<td>3 - CH 332 Physical Chemistry</td>
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<td>1 - CH 340 Physical Chemistry Lab.</td>
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<td>3 - CH 411 Instrumental Analysis</td>
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<td>2 - CH 412 Instrumental Analysis Lab.</td>
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<td></td>
<td>3 - Arts and Humanities (Literature) Requirement</td>
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<td>3 - Elective</td>
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#### Senior Year

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<thead>
<tr>
<th>Semester</th>
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<tbody>
<tr>
<td>First Semester</td>
<td>3 - CH 402 Inorganic Chemistry</td>
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<td>2 - CH 403 Advanced Synthetic Techniques</td>
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<td>3 - CH 443 Research Problems</td>
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<td>3 - CH 444 Research Problems</td>
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<td>3 - CH 450 Chemistry Capstone</td>
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<tr>
<td></td>
<td>3 - Elective</td>
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<tr>
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</tr>
</tbody>
</table>

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 systems design and analysis, applications programming, database administration, and information retrieval, as well as for continued study toward an advanced degree.

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

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

#### Freshman Year

<table>
<thead>
<tr>
<th>Semester</th>
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<tr>
<td>First Semester</td>
<td>4 - CP SC 101 Computer Science I</td>
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<tr>
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<td>3 - ENGL 103 Accelerated Composition</td>
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<td>3 - MTHSC 102 Intro. to Mathemat. Analysis/ and</td>
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<td>4 - MTHSC 106 Calculus of One Variable I</td>
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<td>Second Semester</td>
<td>4 - CP SC 102 Computer Science II</td>
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<td>3 - MTHSC 207 Multivariable Calculus/ and</td>
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<td>3 - Social Science Requirement</td>
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#### Sophomore Year

<table>
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<tr>
<td>First Semester</td>
<td>3 - CP SC 207 Discrete Structures for Computing</td>
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<td>4 - CP SC 212 Algorithms and Data Structures</td>
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<td>3 - Arts and Humanities (Literature) Requirement/ Social Science Require</td>
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<td>3 - Oral Communication Requirement</td>
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<tr>
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<td>3 - Social Science Requirement</td>
</tr>
<tr>
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Second Semester
3 - CP SC 215 Software Development Foundations
4 - CP SC 231 Intro. to Computer Organization
1 - CP SC 291 Seminar in Professional Issues I
3 - MGT 201 Principles of Management
3 - Probability and Statistics Requirement

Junior Year
First Semester
3 - ACCT 201 Financial Accounting Concepts
3 - CP SC 322 Introduction to Operating Systems
3 - CP SC 372 Introduction to Software Engineering
3 - MTHSC 311 Linear Algebra
3 - Writing Requirement

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

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

Second Semester
3 - MGT 312 Decision Models for Management
3 - MKT 301 Principles of Marketing
3 - Computer Science Requirement
3 - Information Systems Requirement
15

122 Total Semester Hours

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 C or better in each CP SC course applied to the degree.

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 3.0 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
3 - CP SC 101 Computer Science I
3 - ENGL 103 Accelerated Composition
4 - MTHSC 106 Calculus of One Variable I
4 - Natural Science Requirement

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

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 Requirement
3 - Oral Communication Requirement

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 Requirement
3 - Elective

Junior Year
First Semester
3 - CP SC 330 Computer Systems Organization
3 - CP SC 360 Networks and Network Program.
3 - CP SC 372 Introduction to Software Engineering
3 - MTHSC 311 Linear Algebra
3 - Social Science Requirement

Second Semester
3 - CP SC 322 Introduction to Operating Systems
3 - CP SC 350 Foundations of Computer Science
3 - CP SC 362 Distributed and Cluster Computing
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
3 - Social Science Requirement

Senior Year
First Semester
3 - CP SC 352 Programming Languages
6 - Computer Science Requirement
3 - Writing Requirement
3 - Elective

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

122 Total Semester Hours

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

College of Engineering and Science

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 earn a grade of C or better in all prerequisite courses (including CP SC and MTHSC courses) before enrolling in the next CP SC course.
COMPUTER SCIENCE

Bachelor of Arts

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

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

Freshman Year
First Semester
- 4 - CP SC 101 Computer Science I
- 3 - ENGL 103 Accelerated Composition
- 3 - MTHSC 102 Intro. to Mathemat. 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 - Elective4 or
  4 - MTHSC 108 Calculus of One Variable II
  3 - Arts and Humanities (Non-Lit.) Req.2
  4 - Foreign Language Requirement3
  15

Sophomore Year
First Semester
- 4 - CP SC 201 Discrete Structures for Computing
- 4 - CP SC 212 Algorithms and Data Structures
- 3 - Arts and Humanities (Literature) Requirement2
- 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
- 3 - Foreign Language Requirement2
- 4 - 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 Requirement2
- 3 - Writing Requirement2
  15

Senior Year
First Semester
- 6 - Computer Science Requirement5
- 3 - Departmental Humanities Requirement8
- 3 - Minor Requirement
- 3 - Social Science Requirement4
  15
Second Semester
- 3 - CP SC 491 Seminar in Professional Issues II
- 3 - Computer Science Requirement5
- 3 - Fine Arts Requirement5
- 3 - Minor Requirement
- 3 - Elective
  15
121 Total Semester Hours

- Select either the MTHSC 102/207 or 106/108 sequence. Students who select the 106/108 sequence will have satisfied the two elective credits in the freshman year. Students interested in computer graphics should select the 106/108 sequence.
- 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.
- Select from courses in A A H, ART, CHIN, DANCE, ENGL, FR, GER, HUM, ITAL, JAPN, MUSIC, P A, PHIL, REL, RUSS, SPAN, THEA.
- Select either the MTHSC 102/207 or 106/108 sequence. Students who select the 106/108 sequence will have satisfied the two elective credits in the freshman year. Students interested in computer graphics should select the 106/108 sequence.
- Select from courses in A A H, ANTH, ART, CHIN, DANCE, ENGL, FR, GER, HUM, ITAL, JAPN, MUSIC, P A, PHIL, REL, RUSS, SPAN, THEA.
- Select from School-approved list.
- Select from courses in A A H, ANTH, ART, CHIN, DANCE, ENGL, FR, GER, HUM, ITAL, JAPN, MUSIC, P A, PHIL, REL, RUSS, SPAN, THEA.
- Select from School-approved list.
- Select from courses in A A H, ANTH, ART, CHIN, DANCE, ENGL, FR, GER, HUM, ITAL, JAPN, MUSIC, P A, PHIL, REL, RUSS, SPAN, THEA.
- Select from School-approved list.
- Select from School-approved list.

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 groundwater systems and applying engineering principles to geologic problems. Graduates from the Hydrogeology Concentration may be taken by students interested in surface and groundwater systems and applying engineering principles to geologic problems. Graduates from the Hydrogeology Concentration work for consulting companies, government agencies and in the natural resources area or go on to graduate study.

Freshman Year
First Semester
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 3 - GEOL 101 Physical Geology
- 1 - GEOL 103 Physical Geology Lab.
- 4 - MTHSC 106 Calculus of One Variable I
  15
Second Semester
- 4 - CH 102 General Chemistry
- 4 - GEOL 102 Earth History
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - Arts and Humanities (Non-Lit.) Requirement3
  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 Geology I
- 1 - GEOL 291 Introduction to Research I
- 1 - Elective
  15
Second Semester
- 4 - CSENV 202 Soils
- 4 - GEOL 212 Geology II
- 1 - GEOL 292 Introduction to Research II
- 3 - PHYS 122 Physics with Calculus I
- 3 - Social Science Requirement4
  15
**Freshman Year**

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

**Second Semester**
- GEOL 300 Environmental Geology
- GEOL 313 Sedimentology and Stratigraphy
- GEOL 392 Research Methods II
- Geology Requirement
- Social Science Requirement
- Elective

**Summer**
- 6 - Summer Geology Field Course

**Sophomore Year**

**First Semester**
- BIOL 103 General Biology I
- BIOL 105 General Biology Lab. I
- GEOL 205 Mineralogy and Intro. Petrology
- GEOL 207 Mineral and Intro. Petrology Lab.
- GEOL 211 Geoanalysis I
- GEOL 291 Introduction to Research I
- Arts and Humanities (Literature) Requirement

**Second Semester**
- BIOL 104 General Biology II
- BIOL 106 General Biology Lab. II
- GEOL 212 Geoanalysis II
- GEOL 292 Introduction to Research II
- GEOL 300 Environmental Geology
- PHYS 122 Physics with Calculus I

**Junior Year**

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

**Second Semester**
- GEOL 381 Introduction to Geochemistry
- GEOL 392 Research Methods II
- Environmental Science Requirement
- Social Science Requirement

**Summer**
- Field Experience

**Senior Year**

**First Semester**
- EN SP 400 Studies in Environmental Science
- GEOL 408 Geohydrology
- GEOL 491 Research Synthesis I
- Environmental Science Requirement

**Second Semester**
- GEOL 418 Introduction to Geochemistry
- GEOL 392 Research Methods II
- Environmental Science Requirement
- Social Science Requirement

**Summer**
- Field Experience

**HYDROGEOLOGY CONCENTRATION**

**Freshman Year**

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

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

**Sophomore Year**

**First Semester**
- GEOL 205 Mineralogy and Intro. Petrology
- GEOL 207 Mineral and Intro. Petrology Lab.
- GEOL 211 Geoanalysis I
- GEOL 291 Introduction to Research I
- Arts and Humanities (Literature) Requirement
- Technical Requirement

**Second Semester**
- GEOL 212 Geoanalysis II
- GEOL 292 Introduction to Research II
- GEOL 300 Environmental Geology
- PHYS 122 Physics with Calculus I
- PHYS 124 Physics Lab. I
- Social Science Requirement

**Junior Year**

**First Semester**
- GEOL 205 Mineralogy and Intro. Petrology
- GEOL 207 Mineral and Intro. Petrology Lab.
- GEOL 211 Geoanalysis I
- GEOL 207 Mineral and Intro. Petrology Lab.
- GEOL 211 Geoanalysis I
- GEOL 291 Introduction to Research I
- Arts and Humanities (Literature) Requirement

**Second Semester**
- GEOL 212 Geoanalysis II
- GEOL 292 Introduction to Research II
- GEOL 300 Environmental Geology
- PHYS 122 Physics with Calculus I
- PHYS 124 Physics Lab. I
- Social Science Requirement

**Summer**
- Field Experience

**Senior Year**

**First Semester**
- GEOL 421 GIS Applications in Geology
- GEOL 491 Research Synthesis I
- Geology Requirement
- Technical Requirement

**Second Semester**
- GEOL 421 GIS Applications in Geology
- GEOL 491 Research Synthesis I
- Geology Requirement
- Technical Requirement

**Summer**
- Field Experience

**ENGLISH & COMPOSITION CONCENTRATION**

**Freshman Year**

**First Semester**
- ENGLISH 101 English Composition I
- ENGLISH 102 English Composition II
- ENGLISH 103 Accelerated Composition
- ENGLISH 109 Introduction to Literature

**Second Semester**
- ART 101 Graphic Design
- ART 102 Basic Drawing
- ART 103 Painting I
- ART 104 Painting II

**Junior Year**

**First Semester**
- ENGLISH 201 English Composition III
- ENGLISH 202 English Composition IV
- ENGLISH 203 English Composition V
- ENGLISH 204 English Composition VI

**Second Semester**
- ENGLISH 301 Advanced English Composition
- ENGLISH 302 Advanced English Composition
- ENGLISH 303 Advanced English Composition
- ENGLISH 304 Advanced English Composition

**Senior Year**

**First Semester**
- ENGLISH 401 Advanced English Composition
- ENGLISH 402 Advanced English Composition
- ENGLISH 403 Advanced English Composition
- ENGLISH 404 Advanced English Composition

**Second Semester**
- ENGLISH 501 Special Topics in English
- ENGLISH 502 Special Topics in English
- ENGLISH 503 Special Topics in English
- ENGLISH 504 Special Topics in English

**Summer**
- Field Experience

**HYDROGEOLOGY CONCENTRATION**

**Freshman Year**

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

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

**Sophomore Year**

**First Semester**
- GEOL 205 Mineralogy and Intro. Petrology
- GEOL 207 Mineral and Intro. Petrology Lab.
- GEOL 211 Geoanalysis I
- GEOL 291 Introduction to Research I
- Arts and Humanities (Literature) Requirement
- Technical Requirement

**Second Semester**
- GEOL 212 Geoanalysis II
- GEOL 292 Introduction to Research II
- GEOL 300 Environmental Geology
- PHYS 122 Physics with Calculus I
- PHYS 124 Physics Lab. I
- Social Science Requirement

**Junior Year**

**First Semester**
- GEOL 205 Mineralogy and Intro. Petrology
- GEOL 207 Mineral and Intro. Petrology Lab.
- GEOL 211 Geoanalysis I
- GEOL 207 Mineral and Intro. Petrology Lab.
- GEOL 211 Geoanalysis I
- GEOL 291 Introduction to Research I
- Arts and Humanities (Literature) Requirement

**Second Semester**
- GEOL 212 Geoanalysis II
- GEOL 292 Introduction to Research II
- GEOL 300 Environmental Geology
- PHYS 122 Physics with Calculus I
- PHYS 124 Physics Lab. I
- Social Science Requirement

**Summer**
- Field Experience

**Senior Year**

**First Semester**
- GEOL 421 GIS Applications in Geology
- GEOL 491 Research Synthesis I
- Geology Requirement
- Technical Requirement

**Second Semester**
- GEOL 421 GIS Applications in Geology
- GEOL 491 Research Synthesis I
- Geology Requirement
- Technical Requirement

**Summer**
- Field Experience
Second Semester
3 - EE&S 401 Environmental Engineering
4 - GEOL 409 Subsurface Methods
3 - GEOL 492 Research Synthesis II
3 - Technical Requirement* 
13
121 Total Semester Hours

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

Spanish is recommended. Two years (through 202) in the same foreign language are required.

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

Select from department-approved list.

Any 300- or 400-level geology course

GEOLOGY
Bachelor of Arts
Freshman Year
First Semester
4 - CH 101 General Chemistry
3 - ENGL 103 Accelerated Composition
3 - GEOL 101 Physical Geology
1 - GEOL 103 Physical Geology Lab.
3 - Mathematics Requirement* 
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 104 General Biology
1 - BIOL 106 General Biology Lab. I
3 - GEOL 205 Mineralogy and Intro. Petrology
1 - GEOL 207 Mineral. and Intro. Petrology Lab.
1 - GEOL 291 Introduction to Research I
3 - Arts and Humanities (Non-Lit.) Requirement* 
4 - Foreign Language Requirement* 
16
Second Semester
3 - BIOL 103 General Biology
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

*See General Education Requirements.

Spanish is recommended. Two years (through 202) in the same foreign language are required.

Any 300- or 400-level geology course

Select from department-approved list.

MATHS 106 and 108 are recommended; however, MATHS 101 and 102 or MATHS 102 and 203 may be substituted.

See General Education Requirements.

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

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

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

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

Freshman Year
First Semester
3 - ECON 211 Principles of Microeconomics
3 - ENGL 103 Accelerated Composition
4 - MATHS 106 Calculus of One Variable I
3 - Arts and Humanities (Non-Lit.) Requirement* 
3 - Foreign Language Requirement* 
16
Second Semester
4 - MATHS 108 Calculus of One Variable II
3 - PHYS 122 Physics with Calculus I
3 - Computer Science Requirement* 
3 - Social Science Requirement* 
16
Sophomore Year
First Semester
3 - MATHS 208 Intro. to Ordinary Diff. Equations
3 - MATHS 302 Statistics for Science and Engr.
3 - Arts and Humanities (Literature) Requirement* 
4 - Natural Science Requirement* 
3 - Elective
17
Junior Year
First Semester
3 - ENGL 314 Technical Writing
3 - MATHS 400 Theory of Probability
3 - MATHS 440 Linear Programming
3 - MATHS 412 Introduction to Modern Algebra
3 - Emphasis Area Requirement* 
3 - Science Requirement* 
15
Second Semester
3 - MATHS 453 Advanced Calculus I
3 - MATHS 454 Advanced Calculus II
3 - Emphasis Area Requirement* 
3 - Science Requirement* 
3 - Elective
15

College of Engineering and Science
### EMPHASIS AREAS

<table>
<thead>
<tr>
<th>Area</th>
<th>Credits</th>
<th>Notes</th>
</tr>
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<tbody>
<tr>
<td>Abstract Mathematics</td>
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<tr>
<td>Mathematical Sciences Requirement</td>
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</tr>
<tr>
<td>Actuarial Science/Financial Mathematics</td>
<td>3</td>
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</tr>
<tr>
<td>Mathematical Sciences Requirement</td>
<td>12</td>
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</tr>
<tr>
<td>Applied and Computational Mathematics</td>
<td>3</td>
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</tr>
<tr>
<td>Computer Science</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Computer Science Requirement</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

### Junior Year

| First Semester                           | 14      |                                                                      |
| Second Semester                          | 15      |                                                                      |

### Sophomore Year

| First Semester                           | 14      |                                                                      |
| Second Semester                          | 15      |                                                                      |

### Senior Year

| First Semester                           | 15      |                                                                      |
| Second Semester                          | 16      |                                                                      |

### 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.

### BIOLOGY CONCENTRATION

| Freshman Year                            | 15      |                                                                      |
| Sophomore Year                           | 15      |                                                                      |
| Junior Year                              | 16      |                                                                      |
| Senior Year                              | 16      |                                                                      |

### Notes

1. For graduation, a candidate for the BS degree in Mathematical Sciences will be required to have a 2.0 or higher cumulative grade-point ratio in all required MTHSC courses.
2. A grade of C or better must be earned in all prerequisite courses before enrolling in the next MTHSC course.

### Mathematical Sciences Bachelor of Arts

| Freshman Year                            | 10      |                                                                      |
| Sophomore Year                           | 14      |                                                                      |
| Junior Year                              | 14      |                                                                      |
| Senior Year                              | 16      |                                                                      |

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

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

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

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

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

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

122 Total Semester Hours

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

Junior Year
First Semester
3 - PHYS 311 Intro. to Meth. of Theoretical Phys.
3 - PHYS 321 Mechanics I
3 - PHYS 325 Experimental Physics I
3 - Emphasis Area Requirement
3 - Physics Writing Requirement

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

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

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

122 Total Semester Hours

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

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

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

Second Semester
1 - PHYS 224 Physics Lab. III
3 - PHYS 122 Physics with Calculus III
4 - MTHSC 208 Intro. to Ordinary Diff. Equations
2. A grade of C or better must be earned in all prerequisite courses before enrolling in the next MTHSC course.

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

Junior Year
First Semester
3 - PHYS 311 Intro. to Meth. of Theoretical Phys.
3 - PHYS 321 Mechanics I
3 - PHYS 325 Experimental Physics I
3 - Emphasis Area Requirement
3 - Physics Writing Requirement

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

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

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

122 Total Semester Hours

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

Two 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.

3ENGL 304, 312, 314, 315, 316, 345, 346, 348, M L 402, or
3THEA (ENGL) 347

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

Second Semester
- CH 102 General Chemistry
- MTHSC 108 Calculus of One Variable II
- PHYS 221 Physics with Calculus I
- PHYS 223 Physics Lab. I
- Oral Communication Requirement
16

Sophomore Year
First Semester
- BIOL 110 Principles of Biology
- MTHSC 206 Calculus of Several Variables
- PHYS 221 Physics with Calculus II
- PHYS 222 Physics Lab. II
- Social Science Requirement
15

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

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

Second Semester
- PHYS 300 Introduction to Research
- PHYS 312 Methods of Theoretical Physics II
- PHYS 322 Mechanics II
- PHYS 336 Modern Physics Overview
- Foreign Language Requirement
- Minor Requirement
15

Senior Year
First Semester
- PHYS 442 Electromagnetics II
- PHYS 455 Quantum Physics I
- Biophysics Requirement
- Physics Writing Requirement
- Science Requirement
15

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

125 Total Semester Hours

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

Second Semester
- CH 102 General Chemistry
- MTHSC 108 Calculus of One Variable II
- PHYS 221 Physics with Calculus I
- PHYS 223 Physics Lab. I
- Oral Communication Requirement
16

Sophomore Year
First Semester
- PHYS 311 Intro. to Meth. of Theoretical Phys.
- PHYS 321 Mechanics I
- PHYS 325 Experimental Physics I
- Biophysics Requirement
- Social Science Requirement

Second Semester
- PHYS 300 Introduction to Research
- PHYS 312 Methods of Theoretical Physics II
- PHYS 322 Mechanics II
- PHYS 336 Modern Physics Overview
- Foreign Language Requirement
- Minor Requirement
15

Senior Year
First Semester
- PHYS 442 Electromagnetics II
- PHYS 455 Quantum Physics I
- Biophysics Requirement
- Physics Writing Requirement
- Science Requirement
15

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

122 Total Semester Hours

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

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

Any 300- or 400-level physics course

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

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

Accounting
Adult/Extension Education
Aerospace Studies
Agricultural Business Management
Agricultural Mechanization and Business
American Sign Language Studies
Animal and Veterinary Sciences
Anthropology
Architecture
Art
Athletic Leadership
Biochemistry
Biological Sciences
Business Administration
Chemistry
Cluster
Communication Studies
Computer Science—not open to Computer Information Systems majors
Crop and Soil Environmental Science
Digital Production Arts
East Asian Studies
Economics
Education
English
Entomology
Entrepreneurship
Environmental Engineering
Environmental Science and Policy
Equine Business
Film Studies
Financial Management
Food Science
Forest 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.