COLLEGE OF ENGINEERING AND SCIENCE

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

Minors
Engineering and science students can complement their majors by selecting minor concentrations of study. Available minors include International Engineering and Science, and one in each of the science majors (see page 113).

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

ENGINEERING PROGRAMS

The Bachelor of Science engineering degree programs in Bioengineering, Biomedical Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Industrial Engineering, Materials Science and Engineering (Inorganic Materials), Materials Science and Engineering (Polymeric Materials) 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.

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

• 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 - ENGR 1070 Programming and Problem Solving I1
2 - ENGR 1060 Engineering Disciplines and Skills I1
3 - ENGL 1030 Accelerated Composition
4 - CH 1010 General Chemistry
5 - PHYS 1220 Physics with Calculus I
6 - PHYS 2070/2090 or PHYS 2000/2100

Second Semester
1 - ENGR 1050 Engineering Disciplines and Skills II
2 - ENGR 1090 Engineering Disciplines and Skills II
3 - ENGR 1090 Programming and Problem Solving I
4 - MATH 1060 Calculus of One Variable I
5 - MATH 1080 Calculus of One Variable II
6 - ENGR 1020 Engineering Disciplines and Skills III
7 - MATH 1080 Calculus of One Variable II
8 - ENGR 1090 Programming and Problem Solving I
9 - GENERAL EDUCATION REQUIREMENT
10 - ENGR 1090 Programming and Problem Solving I
11 - ENGR 1090 Programming and Problem Solving I
12 - ENGR 1090 Programming and Problem Solving I
13 - ENGR 1090 Programming and Problem Solving I
14 - ENGR 1090 Programming and Problem Solving I
15 - ENGR 1090 Programming and Problem Solving I
16 - ENGR 1090 Programming and Problem Solving I
17 - ENGR 1090 Programming and Problem Solving I
18 - ENGR 1090 Programming and Problem Solving I

Registration Requirements
A cumulative grade-point average of 2.0 or higher is required for registration in engineering courses numbered 3000 or higher. Priority for registration in engineering courses is given to those majors for whom the course is a degree requirement. Exceptions to this requirement may be granted by the department offering the course.
Graduation Requirements
In addition to other institutional requirements, candidates for a baccalaureate degree in Engineering are required to have a 2.0 or higher cumulative grade-point average in all engineering courses taken at Clemson. All courses with "Engineering" in the course designator (e.g., ENGR 1300, ME 4530, etc.) are used in this calculation.

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

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

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

Combined Bachelor’s/Master’s Plan
Bioengineering undergraduates may begin a Master of Science degree program or a Master of Engineering 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
4 - CH 1010 General Chemistry
3 - ENGR 1050 Accelerated Composition
1 - ENGR 1060 Engineering Disciplines and Skills I
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Second Semester
4 - CH 1020 General Chemistry
1 - ENGR 1070 Programming and Problem Solving I
1 - ENGR 1080 Programming and Problem Solving II
1 - ENGR 1090 Programming and Problem Solving Applications
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Junior Year
First Semester
4 - BIOL 3150 Functional Human Anatomy
3 - CH 2010 Survey of Organic Chemistry
1 - ECE 3100 Electrical Engineering Lab. I
1 - ECE 3200 Electric Circuits II
2 - ECE 2080 Engineering Graphics and Machine Design
4 - MATH 2080 Intro. to Ordinary Diff. Equations
3 - MSE 2100 Introduction to Materials Science

Second Semester
0 - BIOE 2000 Bioengineering Professional Development
3 - CE 2100 Statics
1 - ECE 2120 Electrical Engineering Lab. II
1 - ECE 2620 Electrical Circuits II
2 - ECE 2070, 2080, 3080) only when all prerequisites have been passed with a grade of C or better.
3 - ECE 3300 Signals, Systems, and Transforms
3 - BCHM 3050 Essential Elements of Biochem.
0 - BIOE 3000 Bioengineering Ethics and Entrepreneurship
3 - BIOE 3200 Biomaterials
3 - BIOE 3700 Bioinstrumentation and Bioimaging
3 - ECE 3800 Electromagnetics
3 - BIOE or ECE Technical Requirement1

BIOELECTRICAL CONCENTRATION
Second Semester
1 - BIOE 4000 Bioengineering Leadership and MedTech Commercialization
3 - BIOE 4030 Applied Biomedical Design
3 - BIOE 4480 Tissue Engineering
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Biomaterials Concentration
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1050 Engineering Disciplines and Skills I
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Second Semester
4 - CH 1020 General Chemistry
1 - ENGR 1070 Programming and Problem Solving I
1 - ENGR 1080 Programming and Problem Solving II
1 - ENGR 1090 Programming and Problem Solving Applications
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Notes:
1. To transfer from General Engineering into the Bioengineering degree program, students must have a minimum cumulative grade-point average of 3.0 in courses taken at Clemson and must have earned a C or better in each course in the General Engineering freshman curriculum, including the Arts and Humanities/Social Science Requirements.
2. A student is allowed to enroll in ECE courses (excluding ECE 2070, 2080, 3080) only when all prerequisites have been passed with a grade of C or better.
3. All Bioelectrical Concentration students must have a cumulative engineering grade-point average of 2.0 to enroll in any 3000- or 4000-level ECE courses.
4. No student may exceed a maximum of two attempts, excluding a W, to complete successfully any ECE course.

BIOMATERIALS CONCENTRATION
Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1050 Engineering Disciplines and Skills I
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Second Semester
4 - CH 1020 General Chemistry
1 - ENGR 1070 Programming and Problem Solving I
1 - ENGR 1080 Programming and Problem Solving II
1 - ENGR 1090 Programming and Problem Solving Applications
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1

Third Semester
3 - BIOL 4610 Cell Biology
0 - BIOE 3000 Bioengineering Ethics and Entrepreneurship
3 - BIOE or ECE Technical Requirement1

Senior Year
First Semester
3 - BIOE 3200 Biomaterials
3 - BIOE 4010 Bioengineering Design Theory
3 - BIOL 4610 Cell Biology
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - BIOE or ECE Technical Requirement1

Second Semester
4 - CH 1020 General Chemistry
1 - ENGR 1070 Programming and Problem Solving I
1 - ENGR 1080 Programming and Problem Solving II
1 - ENGR 1090 Programming and Problem Solving Applications
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - BIOE or ECE Technical Requirement1

128 Total Semester Hours
1See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.
2Students planning to enter medical school should take PHYS 1220/2230 instead of CH 1010/1020 as an additional course sequence. Students planning to enter medical school should also take physics laboratories as additional courses (PHYS 1220 lab and PHYS 2210 course with PHYS 1220 lab). Select from department-approved list.

Notes:
Sophomore Year
First Semester
3 - BIOE 2010 Intro. to Biomedical Engineering
3 - CH 2010 Survey of Organic Chemistry
4 - MATH 2060 Calculus of Several Variables
3 - MSE 2100 Introduction to Materials Science
3 - PHYS 2210 Physics with Calculus II

Second Semester
0 - BIOE 2000 Bioengineering Professional Development
3 - BIOE 3020 Biomaterials
3 - CE 2010 Statics
2 - ECE 2070 Basic Electrical Engineering
1 - ECE 2080 Electrical Engineering Lab. I
2 - ENGR 2080 Engineering Graphics and Machine Design
4 - MATH 2080 Intro. to Ordinary Diff. Equations

Junior Year
First Semester
3 - BIOE 3200 Biomechanics
4 - BIOL 3150 Functional Human Anatomy
3 - MSE 3190 Materials Processing I
3 - MSE 3260 Thermodynamics of Materials
3 - MSE 3270 Transport Phenomena
1
Second Semester
3 - BCHM 3050 Essential Elements of Biochem.
0 - BIOE 3000 Bioengineering Ethics and Entrepreneurship
3 - BIOE 3210 Biofluid Mechanics
3 - BIOE 3700 Bioinstrumentation and Bioimaging
3 - MATH 3020 Statistics for Science and Engr.
3 - Bioengineering Technical Requirement
15

Senior Year
First Semester
3 - BIOE 4010 Bioengineering Design Theory
3 - BIOL 4610 Cell Biology
3 - MSE 4150 Intro. to Polymer Science and Engr.
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
3 - Bioengineering Technical Requirement
15
Second Semester
1 - BIOE 4000 Bioengineering Leadership and MedTech Commercialization
3 - BIOE 4030 Applied Biomedical Design
3 - BIOE 4480 Tissue Engineering
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
6 - Bioengineering Technical Requirement
16
128 Total Semester Hours

*Select from department-approved list.
Note: To transfer from General Engineering into the Bioengineering degree program, students must have a minimum cumulative grade-point average of 3.0 in courses taken at Clemson and must have earned a C or better in each course in the General Engineering freshman curriculum including the Arts and Humanities/Social Science Requirements.

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

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

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

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

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

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

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

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

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

Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1050 Engineering Disciplines and Skills I
1 - ENGR 1060 Engineering Disciplines and Skills II
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement or
3 - Social Science Requirement
16
Second Semester
4 - CH 1020 General Chemistry
1 - ENGR 1070 Programming and Problem Solving I
1 - ENGR 1080 Programming and Problem Solving II
1 - ENGR 1090 Programming and Problem Solving Applications
2 - ENGR 2100 Computer-Aided Design and Engineering Applications
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
16

Sophomore Year
First Semester
2 - ENGR 2100 Fundamentals of Biosystems Engr.
3 - CE 2010 Statics
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
4 - Biology Requirement
16
Second Semester
2 - ENGR 2100 Intro. to Biosystems Engineering
2 - CE 2080 Dynamics
4 - MATH 2080 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
4 - Biology Requirement
16

Junior Year
First Semester
3 - BE 3200 Principles and Practices of Geomatics
3 - BE 4100 Biol. Kinetics and Reactor Modeling
3 - BIOL 4410 Ecology
4 - CE 3410 Introduction to Fluid Mechanics
2 - ECE 2070 Basic Electrical Engineering
1 - ECE 2080 Electrical Engineering Lab. I
15
Second Semester
3 - BE 3220 Small Watershed Hydrology and Sedimentology
3 - BE 4120 Heat and Mass Transport in Biosystems Engineering
4 - BE 4150 Instrumentation and Process Control for Biosystems Engineering
3 - BE 4380 Bioprocess Engineering Design
3 - CH 2230 Organic Chemistry
1 - CH 2270 Organic Chemistry Laboratory

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*Students should choose courses to fulfill General Education requirements including Humanities, Social Science, Cross-Cultural Awareness and Science and Technology in society components. See Undergraduate Announcements and academic advisor for details.

1 ME 2010 may be substituted for CE 2010 and 2080.
1 BIOL 1030/1050 or 1100

BIOPROCESS ENGINEERING EMPHASIS AREA
Senior Year
First Semester
3 - BCHM 3050 Biochemistry
3 - BE 4280 Biochemical Engineering
2 - BE 4740 Biosystems Engr. Design/Project Mgt.
2 - BE 4750 Biosystems Engr. Capstone Design
2 - BIOL 4340 Biol. Chemical Lab. Techniques
4 - CE 2060 Structural Mechanics
16

Second Semester
9 - Arts and Humanities Requirement1 or
9 - Social Science Requirement1
3 - Global Sustainability Requirement2
- 15

127 Total Semester Hours

*Any 3000-level or higher ENGR or other approved course.
*Select from Sustainability Minor course list or other approved course.

ECOLOGICAL ENGINEERING EMPHASIS AREA
Senior Year
First Semester
3 - BE 4210 Engineering Systems for Soil Water Management
2 - BE 4740 Biosystems Engr. Design/Project Mgt.
2 - BE 4750 Biosystems Engr. Capstone Design
4 - CE 2060 Structural Mechanics
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Ecological Requirement1
16

Second Semester
3 - BE 4240 Ecological Engineering
6 - Arts and Humanities Requirement1 or
6 - Social Science Requirement1
3 - Engineering Requirement3
3 - Global Sustainability Requirement6
15

127 Total Semester Hours

*Ecological Requirement: Choose from BIOL, FOR, HORT, MICR, PES/WFB 3000-level or above or other approved course.
*Any 3000-level or higher ENGR or other approved course.
*Select from Sustainability Minor course list or other approved course.

Notes for Bioprocess and Ecological Engineering emphasis areas:
1. The following must be completed with C or better: CE 2010, 2060, 2080, 3410; MATH 2060, 2080; ME 3100; PHYS 2210.
2. Biosystems Engineering students are encouraged to complete a Minor, Coop Ed program, internship (BE 3700) and/or a Study Abroad Program.
3. Departmental Honors Thesis (BE 3000/3010/4000) is available for qualifying Junior/Senior students.

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

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

The Educational Objective of the BS degree program is for graduates to have careers characterized by:
- success in chemical engineering practice, post-graduate education, or other areas making use of engineering skills, as defined by accomplishments and/or job satisfaction;
- demonstrated success in the design of chemical processes and/or identification, formulation, and solution of chemical engineering problems;
- ethical behavior in all endeavors;
- demonstrated effectiveness in teamwork, communication, and service to society through professional contributions;
- demonstrated technical and/or managerial leadership; and
- demonstrated commitment to lifelong learning.

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

Combined Bachelor of Science/Master of Science
Qualified students can reduce the time to earn a Master’s Degree by applying graduate credits to both the Bachelor’s and Master’s program requirements. Undergraduate Chemical and Biomolecular Engineering students who have earned a grade-point average of 3.4 or above and completed 90 credit hours can begin work toward a Master of Science in Chemical Engineering or a Master of Science in Environmental Engineering and Science by selecting approved graduate courses for their emphasis area.

Details are available in the ChBE Undergraduate Handbook, which can be found at www.clemson.edu/ces/chbe.

Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1050 Engineering Disciplines and Skills I
1 - ENGR 1060 Engineering Disciplines and Skills II
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Second Semester
4 - CH 1020 General Chemistry
2 - CHE 1300 Chemical Engineering Tools
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Sophomore Year
First Semester
3 - CH 2230 Organic Chemistry
4 - CHE 2110 Intro. to Chemical Engineering
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Second Semester
3 - CH 2240 Organic Chemistry
1 - CH 2290 Organic Chemistry Lab.
3 - CHE 2200 Chemical Engr. Thermodynamics I
4 - CHE 2300 Fluids/Heat Transfer
4 - MATH 2080 Intro. to Ordinary Diff. Equations
15

Junior Year
First Semester
1 - CH 3390 Physical Chemistry Lab.
3 - CHE 3070 Unit Operations Lab. I
3 - CHE 3190 Engineering Materials
2 - ECE 2070 Basic Electrical Engineering
1 - ECE 2080 Electrical Engineering Lab. I
3 - STAT 4110 Statistical Methods for Process Development and Control
3 - Biochemistry Option2 or
3 - Emphasis Area1
16

Second Semester
3 - CH 3320 Physical Chemistry
1 - CH 3400 Physical Chemistry Lab.
3 - CHE 3120 Chemical Engr. Thermodynamics II
4 - CHE 3300 Mass Transfer and Separation Proc.
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
3 - Biochemistry Option2 or
3 - Emphasis Area1
17
## Senior Year
### First Semester
- 3 - CHE 4070 Unit Operations Lab. II
- 3 - CHE 4310 Chemical Process Design I
- 1 - CHE 4430 Chemical Engr. Senior Seminar I
- 3 - CHE 4500 Chemical Reaction Engineering
- 3 - Arts and Humanities Requirement\(^1\) or 3 - Social Science Requirement\(^1\)
- 3 - Emphasis Area Requirement\(^1\)

### Second Semester
- 3 - CHE 3350 Process Dynamics and Control
- 3 - CHE 4330 Process Design II
- 1 - CHE 4440 Chemical Engr. Senior Seminar II
- 3 - MICR 4130 Industrial Microbiology
- 3 - Arts and Humanities Requirement\(^1\) or 3 - Social Science Requirement\(^1\)
- 3 - Emphasis Area Requirement\(^1\)

129 Total Semester Hours

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1. See Policy on Humanities and Social Sciences for Engineer- ing Curricula. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.
2. Select one course from BCHM 3050 or BMOL 4250, or CH 3600.
3. See advisor for details. Nine credit hours devoted to completion of an emphasis area or approved minor are required. Emphasis areas are Applied Engineering, Mathematics and Science, Bio- molecular Science and Engineering, Business Management, En- vironmental Engineering, Polymeric Materials, and Energy Studies.

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

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### BIOMOLECULAR ENGINEERING CONCENTRATION
#### Freshman Year
### First Semester
- 4 - CH 1010 General Chemistry
- 3 - ENG 1030 Accelerated Composition
- 1 - ENGR 1050 Engineering Disciplines and Skills I
- 1 - ENGR 1060 Engineering Disciplines and Skills II
- 4 - MATH 1060 Calculus of One Variable I
- 3 - Arts and Humanities Requirement\(^1\) or 3 - Social Science Requirement\(^1\)

16

### Second Semester
- 4 - CH 1020 General Chemistry
- 2 - CHE 1300 Chemical Engineering Tools
- 4 - MATH 1080 Calculus of One Variable II
- 3 - PHYS 1220 Physics with Calculus I
- 3 - Arts and Humanities Requirement\(^1\) or 3 - Social Science Requirement\(^1\)

16

### Sophomore Year
### First Semester
- 5 - BIOL 1100 Principles of Biology I
- 3 - CH 2230 Organic Chemistry
- 4 - CHE 2110 Intro. to Chemical Engineering
- 4 - MATH 2060 Calculus of Several Variables
- 3 - Arts and Humanities Requirement\(^1\) or 3 - Social Science Requirement\(^1\)

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### Second Semester
- 2 - BIOL 4340 Biological Chem. Lab. Techniques
- 3 - CH 2240 Organic Chemistry
- 1 - CH 2290 Organic Chemistry Lab.
- 3 - CHE 2200 Chemical Engr. Thermodynamics I
- 4 - CHE 2300 Fluids/Heat Transfer
- 3 - Biochemistry Option

16

### Junior Year
#### First Semester
- 3 - CHE 4070 Unit Operations Lab. II
- 3 - CHE 4310 Chemical Process Design I
- 1 - CHE 4430 Chemical Engr. Senior Seminar I
- 3 - CHE 4500 Chemical Reaction Engineering
- 3 - STAT 4110 Statistical Methods for Process Development and Controls
- 3 - Engineering Requirement

16

### Second Semester
- 3 - BMOL 4250 Biomolecular Engineering
- 3 - CHE 3210 Chemical Engr. Thermodynamics II
- 4 - CHE 3300 Mass Transfer and Separation Proc.
- 3 - PHYS 2210 Physics with Calculus II
- 3 - Arts and Humanities Requirement\(^1\) or 3 - Social Science Requirement\(^1\)

16

### Senior Year
#### First Semester
- 3 - CHE 4070 Unit Operations Lab. II
- 3 - CHE 4310 Chemical Process Design I
- 1 - CHE 4430 Chemical Engr. Senior Seminar I
- 3 - CHE 4500 Chemical Reaction Engineering
- 6 - Arts and Humanities Requirement\(^1\) or 6 - Social Science Requirement\(^1\)

16

131 Total Semester Hours

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1. See Policy on Humanities and Social Sciences for Engineer- ing Curricula. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.
2. Select from BCHM 3050 or BMOL 4250, or CH 3600.
3. Select from CHE 4010 or BMOL 4030, 4230, 4260, 4270, BE 4280, MICR 4130.

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

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### 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 94 for the College of Engineering and Science. The complete objectives of the program can be found at www.clemson.edu/ce.
Sophomore Year
First Semester
3 - CE 2100 Statics
3 - CE 2550 Geometrics
4 - MATH 2160 Calculus of Several Variables
3 - PHYS 2110 Physics with Calculus II
1 - PHYS 2230 Physics Lab. II
3 - Arts and Humanities Requirement1 or 3 - Social Science Requirement1
17
Second Semester
4 - CE 2060 Structural Mechanics
2 - CE 2080 Dynamics
2 - CE 3520 Economic Evaluation of Projects
3 - COMM 2500 Public Speaking
4 - MATH 2080 Intro. to Ordinary Diff. Equations
15
Junior Year
First Semester
3 - CE 3010 Structural Analysis
3 - CE 3110 Construction Engineering and Mgt.
4 - CE 3410 Introduction to Fluid Mechanics
4 - CE 3510 Civil Engineering Materials
3 - MATH 3020 Statistics for Engineering and Science
17
Second Semester
3 - CE 3110 Transportation Engineering Planning and Design
4 - CE 3210 Geotechnical Engineering
4 - CE 3420 Applied Hydraulics and Hydrology
1 - CE 3530 Professional Seminar
3 - EES 4010 Environmental Engineering
3 - Design Technical Requirement2
17
Senior Year
First Semester
3 - ENGL 3140 Technical Writing
3 - Design Technical Requirement2
6 - Technical Requirement1
3 - Technical Requirement Restricted1
15
Second Semester
3 - CE 4590 Capstone Design Project
3 - Arts and Humanities Requirement3 or 3 - Social Science Requirement3
3 - Arts and Humanities (Literature) Requirement3
3 - Technical Requirement3
3 - Elective
129 Total Semester Hours

Notes:
1. Civil Engineering students may neither enroll in nor receive credit for any CE or EM course unless they have a 2.0 Engineering grade-point average.
2. Civil Engineering students enrolling in any CE course (except CE 4590) must have a grade of C or better in the prerequisites for that course.

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
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1070 Programming and Problem Solving
1 - ENGR 1080 Programming and Problem Solving II
1 - ENGR 1090 Programming and Problem Solving III
3 - CPSC 1110 Elementary Computer Programming in C/C++
16
Second Semester
1 - ECE 1010 Intro. to Electrical Engineering
1 - ECE 1020 Intro. to Electrical Engineering II
3 - ECE 1040 Introduction to Computer Science
1 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - PHYS 1230 Physics with Calculus II
16
Sophomore Year
First Semester
3 - CPSC 1110 Elementary Computer Programming in C/C++
2 - ECE 2100 Logic and Computing Devices
3 - ECE 2220 Systems Programming Concepts for Computer Engineering
1 - ECE 2310 Computer Systems Engineering
1 - ECE 2410 Digital Logic Design
1 - ECE 2510 Electric Circuits I
3 - ECE 2720 Computer Organization Laboratories
3 - ECE 3170 Random Signal Analysis
3 - ECE 3200 Electronics I
3 - ECE 3510 Digital System Design
3 - ECE 3520 Programming Systems
3 - MATH 1050 Engineering Calculus I
3 - MATH 1050 Engineering Calculus II
9
ELECTRICAL ENGINEERING
Bachelor of Science
Electrical engineers are in high demand for a wide range of influential positions. Professional duties range from analytical problem solving to the design of components and systems. The scope of employment requires a unique breadth and depth of knowledge and technical skills, which are reflected in the Electrical Engineering program. This program also offers an excellent preparation for graduate education. Detailed information can be found at www.clemson.edu/ces/departments/ece/.

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

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

Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Writing with Technology
1 - ENGR 1070 Programming and Problem Solving I
4 - MATH 1080 Calculus of One Variable I
3 - Arts and Humanities Requirement or Social Science Requirement

Second Semester
4 - CH 1020 General Chemistry
1 - ENGR 1080 Programming and Problem Solving II
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1090 Programming and Problem Solving Applications
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement or Social Science Requirement

Sophomore Year
First Semester
3 - CPSC 1110 Elementary Computer Programming in C/C++
2 - ECE 2100 Logic and Computer Devices
3 - ECE 2200 Digital Systems I
1 - ECE 2290 Logic and Computing Devices Lab.
1 - ECE 2110 Electrical Engineering Lab. I
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II

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

Junior Year
First Semester
1 - ECE 3110 Electrical Engineering Lab. III
3 - ECE 3200 Electronics I
3 - ECE 3300 Signals, Systems, and Transforms
3 - ECE 3600 Electric Power Engineering
3 - ECE 3800 Electromagnetics
3 - Advanced Mathematics Requirement

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

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

Second Semester
2 - ECE 4960 Integrated System Design II
3 - Arts and Humanities Requirement or Social Science Requirement
6 - Electrical Engineering Technical Requirement
3 - Special Requirement

126 Total Semester Hours

Notes:
1. Any student is allowed to enroll in ECE courses (excluding ECE 2070, 2080, 3000) only when all prerequisites have been passed with a grade of C or better.
2. All Electrical Engineering students must have a cumulative engineering grade-point average of 2.0 to enroll in any 3000 or 4000-level ECE courses.
3. No student may exceed a maximum of two attempts, excluding one additional course selected from MATH 3110, 4120, 4190, 4340, 4350, or 4530, or any additional three-credit, 4000-level course from the departmental Computer Engineering Technical Requirement list or Electrical Engineering Technical Requirement list; or one additional course selected from MATH 3110, 4120, 4190, 4340, 4350, 4410, 4410, 4530, or 4540.

Second Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1050 Engineering Disciplines and Skills I
1 - ENGR 1060 Engineering Disciplines and Skills II
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement or Social Science Requirement

Sophomore Year
First Semester
3 - BIOL 1030 General Biology
2 - EES 2020 Environmental Engineering Fund. II
2 - CE 2080 Dynamics
3 - CE 2010 Statics
3 - EES 2010 Environmental Engineering Fund. I
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II

Second Semester
4 - CH 1020 General Chemistry
1 - ENGR 1070 Programming and Problem Solving I
1 - ENGR 1080 Programming and Problem Solving II
1 - ENGR 1090 Programming and Problem Solving Applications
3 - HIST 1240 Environmental History Survey
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 2220 Physics with Calculus II

Junior Year
First Semester
4 - EES 2010 Environmental Engineering Fund. I
3 - EES 2020 Environmental Engineering Fund. II
2 - EGR 2100 Computer-Aided Design and Engineering Applications
4 - MATH 2080 Intro. to Ordinary Diff. Equations

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 127 credit hours. All students participate in one professional seminar course and complete a capstone design project.
Junior Year
First Semester
2 - EES 1030 Water Treatment
2 - EES 1040 Wastewater Treatment
1 - EES 1050 Water and Wastewater Treatment Lab
3 - MATH 1020 Statistics for Science and Engineering
4 - MICR 1050 General Microbiology
3 - Arts and Humanities Requirement or 3 - Social Science Requirement

Second Semester
4 - CE 3410 Introduction to Fluid Mechanics
3 - EES 4840 Municipal Solid Waste Management
3 - EES 4850 Hazardous Waste Management
3 - GEOL 1010 Physical Geology
1 - GEOL 1030 Physical Geology Lab
3 - ME 3100 Thermodynamics and Heat Transfer

Senior Year
First Semester
3 - EES 4430 Air Pollution Engineering
1 - EES 4500 Environ. Engr. Senior Seminar
3 - EES 4800 Environmental Risk Assessment
3 - EES 4860 Environmental Sustainability
2 - Engineering Economics Requirement
3 - Engineering or Science Requirement

Second Semester
3 - EES 4750 Capstone Design Project
6 - Engineering or Science Requirement
6 - Arts and Humanities Requirement or 6 - Social Science Requirement

127 Total Semester Hours

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

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

May substitute BIOL 1100 for BIOL 1050 or BIOL 1050, BIOL 1100 is five hours.
May substitute CH 2230.
May substitute ENGR 2080.
May substitute PES 2020 for GEOL 1010 or GEOL 1030.
Select CE 3520 or IE 3840.
Select any combination of engineering and/or science courses from a department-approved list.

Notes:
1. The following courses must be completed with a C or better: CE 2010, CE 2080, ENGR 2080, MATH 2080.

INDUSTRIAL ENGINEERING

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

The traditional arenas for the practice of industrial engineering are the manufacturing facilities of industry; however, many practicing industrial engineers are employed in non-manufacturing institutions such as hospitals, banks, and government agencies. In addition to numerous employment opportunities in professional practice, industrial engineering graduates may further their formal education. The Department of Industrial Engineering offers programs leading to the Master of Science and Doctor of Philosophy degrees.

The Department of Industrial Engineering allows students to count up to 12 hours of graduate credit (approved 6000- and 8000-level courses) toward both bachelor’s and master’s degrees. Moreover, the total number of hours for both the BS and MS degree must be at least 150; most BSIE students cannot double-count more than six units. To be eligible, the student must have completed the bachelor’s curriculum through the junior year (minimum 90 credits) and have a minimum overall grade point average of 3.4. Details of the suggested curriculum and program information are available from the Industrial Engineering Department.

Detailed curriculum and department information is available at http://www.clemson.edu/ce/departments/ie/.

Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1050 Engineering Disciplines and Skills
1 - ENGR 1060 Engineering Disciplines and Skills
4 - MATH 1060 Calculus of One Variable
3 - Arts and Humanities Requirement or 3 - Social Science Requirement

Second Semester
1 - ENGR 1070 Programming and Problem Solving
1 - ENGR 1080 Programming and Problem Solving
1 - ENGR 1090 Programming and Problem Solving Applications
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus
3 - Arts and Humanities Requirement or 3 - Social Science Requirement
4 - Lab Science Requirement

Sophomore Year
First Semester
1 - IE 2000 Sophomore Seminar in IE
4 - IE 3010 System Design I
3 - IE 2800 Methods of Operational Research I
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
1 - PHYS 2230 Physics Lab. II

Second Semester
3 - CE 2010 Statics
2 - ENGR 2080 Engineering Graphics and Machine Design
2 - ENGR 2090 Introduction to Engineering/Computer Graphics
3 - IE 2100 Design and Analysis of Work Systems
3 - IE 3840 Engineering Economic Analysis
3 - MSE 2100 Introduction to Materials Science
3 - Arts and Humanities Requirement or 3 - Social Science Requirement

Junior Year
First Semester
3 - IE 3600 Design and Control of Industrial Sys. I
1 - IE 3680 Professional Practice in IE
3 - IE 4400 Decision Support Systems in IE
6 - Arts and Humanities Requirement or 6 - Social Science Requirement
3 - Ethics and Professional Practice Requirement

Second Semester
2 - ECE 2020 Electric Circuits I and
1 - ECE 2110 Electrical Engineering Lab. I or
2 - ECE 2070 Basic Electrical Engineering and
1 - ECE 2080 Electrical Engineering Lab. I
3 - IE 3610 Design and Control of Industrial Sys. II
3 - IE 3810 Methods of Operational Research II
3 - IE 3860 Production Planning and Control
3 - Oral Communication Requirement

Senior Year
First Semester
3 - IE 4610 Quality Engineering
3 - IE 4650 Facilities Planning and Design
4 - IE 4820 Systems Modeling
6 - Technical Requirement

Second Semester
3 - IE 4670 Systems Design II
3 - Management Requirement
3 - Mathematics or Natural Science Requirement
3 - Technical Requirement

125 Total Semester Hours

This course must be passed with a C or better either to transfer into IE from General Engineering or to satisfy later course prerequisites.

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

Select from department-approved list. See advisor.

PHYS 1240 may be substituted.

ME 2010 may be substituted.

See General Education Requirements. COMM 1500 is recommended.

101
MATERIALS SCIENCE AND ENGINEERING

Bachelor of Science

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

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

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

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

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

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

INORGANIC MATERIALS CONCENTRATION

Freshman Year

First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1050 Engineering Disciplines and Skills I
1 - ENGR 1060 Engineering Disciplines and Skills II
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Second Semester
4 - CH 1020 General Chemistry
1 - ENGR 1070 Programming and Problem Solving I
1 - ENGR 1080 Programming and Problem Solving II
1 - ENGR 1090 Programming and Problem Solving Applications
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Sophomore Year

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

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

Junior Year

First Semester
3 - COMM 2500 Public Speaking
3 - MSE 3190 Materials Processing I
3 - MSE 3260 Thermodynamics of Materials
3 - MSE 3270 Transport Phenomena
3 - MSE 4150 Intro. to Polymer Sci. and Engr.
15

Second Semester
3 - IE 3840 Engineering Economic Analysis
3 - MATH 3020 Statistics for Science and Engr. or
3 - STAT 2300 Statistical Methods I
3 - MSE 3280 Phase Diagrams for Materials Processing and Applications
2 - MSE 3420 Structure/Property Laboratory
3 - MSE 3610 Proc. Metals and Their Composites
3 - MSE 4220 Mechanical Behavior of Materials
17

Senior Year

First Semester
3 - MSE 4020 Solid State Materials
3 - MSE 4130 Noncrystalline Materials
3 - MSE 4320 Manufacturing Processes and Sys.
1 - MSE 4410 Manufacturing Laboratory
3 - MSE 4910 Undergraduate Research
13

Second Semester
4 - MSE 4070 Senior Capstone Design
3 - MSE 4160 Electrical Properties of Materials
3 - MSE 4240 Optical Materials and Applications
3 - MSE 4330 Combustion System and Environmental Emissions
1 - MSE 4450 Practice of Materials Engineering
13

124 Total Semester Hours

POLYMERIC MATERIALS CONCENTRATION

Freshman Year

First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1050 Engineering Disciplines and Skills I
1 - ENGR 1060 Engineering Disciplines and Skills II
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
16

Second Semester
4 - CH 1020 General Chemistry
1 - ENGR 1070 Programming and Problem Solving I
1 - ENGR 1080 Programming and Problem Solving II
1 - ENGR 1090 Programming and Problem Solving Applications
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Sophomore Year

First Semester
3 - CH 2010 Survey of Organic Chemistry
1 - CH 2270 Organic Chemistry Laboratory
3 - MSE 2100 Introduction to Materials Science
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
3 - Arts and Humanities Requirement1 or
3 - Social Science Requirement1
17

Second Semester
4 - CH 1020 General Chemistry
1 - CH 2270 Organic Chemistry Laboratory
3 - MSE 2100 Introduction to Materials Science
4 - MATH 2080 Intro. to Ordinary Diff. Equations
3 - MSE 2500 Polymer & Fiber Science I
16
Junior Year
First Semester
3 - CH 3310 Physical Chemistry
3 - COMM 2500 Public Speaking
3 - MSE 3270 Transport Phenomena
3 - MSE 4150 Intro. to Polymer Sci. and Engineering
3 - MSE 4550 Polymer and Fiber Lab.
3 - Social Science Requirement1 or 2
16
Second Semester
3 - CH 3320 Physical Chemistry
3 - IE 3840 Engineering Economic Analysis
3 - MATH 3020 Stat. for Science and Engr.
3 - STAT 2300 Statistical Methods I
3 - MSE 4220 Mechanical Behavior or Materials
3 - MSE 4560 Polymer and Fiber Science II
15
Senior Year
First Semester
3 - MSE 4580 Surface Phenomena in Materials Science and Engineering
1 - MSE 4600 Surface Phenomena in Materials Science and Engineering Laboratory
3 - MSE 4610 Polymer and Fiber Science III
3 - MSE 4910 Undergraduate Research
3 - Technical Requirement2
13
Second Semester
3 - MSE 4070 Senior Capstone Design
1 - MSE 4450 Practice of Materials Engineering
3 - MSE 4570 Color Science
1 - MSE 4590 Color Science Laboratory
3 - Social Science Requirement1 or 2
3 - Technical Requirement2
16
124 Total Semester Hours

Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
1 - ENGR 1050 Engineering Disciplines and Skills I
1 - ENGR 1060 Engineering Disciplines and Skills II
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities (Non-Lit.) Requirement1 or 2
3 - Social Science Requirement1
16
Second Semester
1 - ENGR 2080 Engineering Graphics and Machine Design
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
1 - PHYS 1240 Physics Lab. I
3 - Arts and Humanities (Lit.) Requirement1 or 2
3 - Social Science Requirement1
16

Sophomore Year
First Semester
1 - ME 2000 Sophomore Seminar
5 - ME 2010 Statics and Dynamics for Mech. Engr.
2 - ME 2220 Mechanical Engineering Lab. I or 2
3 - MSE 2100 Intro. to Materials Science2
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
15-16
Second Semester
2 - ECE 2070 Basic Electrical Engineering
1 - ECE 2080 Electrical Engineering Lab. I
3 - ME 2030 Found. of Thermal and Fluid Systems
3 - ME 2040 Mechanics of Materials
2 - ME 2220 Mechanical Engineering Lab. I or 2
3 - MSE 2100 Intro. to Materials Science2
4 - MATH 2080 Intro. to Ordinary Diff. Equations
15-16
Junior Year
First Semester
3 - ENGL 3140 Technical Writing
3 - ME 3330 Mechanical Engineering Lab. II or 3
2 - ENGR 2080 Engineering Graphics and Machine Design
3 - ME 3050 Model. and Analysis of Dynamic Syst.
3 - ME 3060 Fundamentals of Machine Design
2 - MSE 3330 Manufacturing Processes and Their Application
2 - ME 3330 Mechanical Engineering Lab. II or 3
3 - Statistics Requirement1 or 2
15-16
Second Semester
3 - ME 3040 Heat Transfer
3 - ME 3050 Model. and Analysis of Dynamic Syst.
3 - ME 3060 Fundamentals of Machine Design
3 - ME 3120 Manufacturing Processes and Their Application
2 - ME 3330 Mechanical Engineering Lab. II or 3
3 - Statistics Requirement1 or 2
14-15

Senior Year
First Semester
3 - ME 4220 Mechanical Behavior or Materials
3 - ME 4440 Mechanical Engineering Lab. II or 3
3 - Statistics Requirement1 or 2
14
Second Semester
1 - ME 4000 Senior Seminar
3 - ME 4030 Control and Integration of Multi-Domain Dynamic Systems
2 - ME 4440 Mechanical Engineering Lab. III or 3
3 - Technical Requirement1 or 2
3 - Arts and Humanities Requirement1 or 2
3 - Social Science Requirement1 or 2
3 - Mechanical Engineering Technical Requirement4
15-16
125 Total Semester Hours

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

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

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

Mechanical Engineering students who have a cumulative grade-point average or cumulative engineering grade-point average (EGPA) below 2.0 are on probation and will have restricted enrollment in classes. Students whose cumulative grade-point average is below 2.0 are subject to the regulations stipulated under Academic Eligibility Policy. Students on probation for EGPR below 2.0 who fail to recover in the first regular semester (fall or spring) will not be allowed to register for mechanical engineering classes. After one year, such students may petition the 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.clemson.edu/me.

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

2See advisor.

Both are required but may be taken in either semester.
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, Mathematical Sciences, and Physics.

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

Bachelor of Science Curricula

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

Bachelor of Arts Curricula

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

Students have a large degree of flexibility and responsibility in selecting a minor from those listed on page 113. Courses for these minors are to be selected in consultation with the appropriate department.

CHEMISTRY

Bachelor of Science

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

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

Freshman Year

First Semester

3 - CH 1010 General Chemistry
1 - CH 1410 Chemistry Orientation
3 - ENGL 1030 Accelerated Composition
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities Requirement1 or 2
— 3 - Social Science Requirement1
15

Second Semester

4 - CH 1020 General Chemistry
2 - CH 1520 Chemistry Communication I
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities Requirement1 or 2
— 3 - Social Science Requirement1
16

Sophomore Year

First Semester

3 - CH 2230 Organic Chemistry
1 - CH 2270 Organic Chemistry Lab.
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2210 Physics with Calculus II
1 - PHYS 2230 Physics Lab. II
4 - Foreign Language Requirement2
16

Second Semester

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

Junior Year

First Semester

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

Second Semester

3 - CH 3320 Physical Chemistry
1 - CH 3400 Physical Chemistry Lab.
3 - CH 3600 Chemical Biology
3 - CH 4110 Instrumental Analysis
2 - CH 4120 Instrumental Analysis Lab.
3 - Arts and Humanities (Literature) Requirement1 or 2
15

Senior Year

First Semester

3 - CH 4020 Inorganic Chemistry
3 - CH 4430 Research Problems
3 - Arts and Humanities Requirement1 or 2
— 3 - Social Science Requirement1
3 - Chemistry Requirement3
3 - Elective
15

Second Semester

2 - CH 4030 Advanced Synthetic Techniques
3 - CH 4440 Research Problems
3 - CH 4500 Chemistry Capstone
1 - CH 4520 Chemistry Communication II
3 - Arts and Humanities Requirement1 or 2
— 3 - Social Science Requirement1
2 - 12 Total Semester Hours

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

One semester (through 1020) in any modern foreign language is required.

See advisor.

BCHM 3050 may be substituted for CH 3600.
Second Semester
3 - CH 2050 Introduction to Inorganic Chemistry
3 - CH 2240 Organic Chemistry
1 - CH 2280 Organic Chemistry Lab.
6 - Arts and Humanities Requirement or Social Science Requirement
- Foreign Language Requirement
17

Junior Year
First Semester
3 - CH 3130 Quantitative Analysis
1 - CH 3170 Quantitative Analysis Lab.
3 - CH 3310 Physical Chemistry
3 - Arts and Humanities Requirement or Social Science Requirement
- Foreign Language Requirement
3 - Minor Requirement
16

Second Semester
3 - CH 3320 Physical Chemistry
3 - ENGL 3140 Technical Writing
3 - Arts and Humanities (Literature) Requirement
- Foreign Language Requirement
3 - Minor Requirement
15

Senior Year
First Semester
3 - Arts and Humanities Requirement or Social Science Requirement
3 - Chemistry Requirement
3 - Foreign Language Requirement
3 - Minor Requirement
6 - Elective
15

Second Semester
3 - CH 4500 Chemistry Communication II
1 - CH 4520 Chemistry Capstone
3 - Minor Requirement
17

Sophomore Year
First Semester
3 - CPSC 1010 Computer Science I
4 - CPSC 1110 and 2100 will be accepted in place of CPSC 1010 and 1020.
3 - ENGL 1030 Accelerated Composition
3 - MATH 1020 Intro. to Mathemat. Analysis
4 - MATH 1060 Calculus of One Variable I
4 - Natural Science Requirement
- Elective
15

Second Semester
4 - CPSC 1020 Computer Science II
3 - MATH 2070 Multivariable Calculus or MATH 1080 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit) Requirement
3 - Natural Science Requirement
3 - Social Science Requirement
- Elective
17

Junior Year
First Semester
3 - ACCT 2100 Financial Accounting Concepts
3 - CPSC 2200 Microcomputer Applications
3 - CPSC 3220 Introduction to Operating Systems
3 - CPSC 3720 Intro. to Software Engineering
3 - Writing Requirement
15

Second Semester
3 - ACCT 2100 Managerial Accounting Concepts
3 - CPSC 3600 Networks and Network Program.
3 - CPSC 3710 Systems Analysis or CPSC 3710 Systems Analysis
3 - MGT 4520 Systems Analysis and Design
3 - ECON 2110 Principles of Microeconomics
3 - Computer Science Requirement
15

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

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

Second Semester
3 - MGT 3120 Decision Models for Management
3 - MKT 3010 Principles of Marketing
3 - Business Requirement
3 - Computer Science Requirement
3 - Information Systems Requirement
15

122 Total Semester Hours

1The sequence of CPSC 1110 and 2100 will be accepted in place of CPSC 1010 and 1020.
2Select either the MATH 1020/2070, 1060/2070 or 1060/1080 sequence. Students who select the 1060/1080 sequence will have satisfied the two elective credits in the freshman year.
3Select from courses in BIOL, BCHM, CH, GEOL, MICRO, PHYS, or ENSP 2000. At least one course must include a laboratory and satisfy the Natural Science General Education Requirement.
4See General Education Requirements.
5MATH 1190 may be substituted.
6Select from: COMM 1500, 2500, HON 2230; or the cluster of courses AS 3090, 3100, 4090, 4010, or ML 1010, 1020.
7MATH 3020 or STAT 3300 may be substituted.
8Select from: ENGL 3040, 3120, 3140, 3150, 3160, 3330; AS 3090, 3100, 4090, 4100; ML 3010, 3100, 4010, 4020.
9Select from 3000-level or higher CPSC courses or DPA 3070. No more than three credits of CPSC 3990 or 4810 may be applied to this requirement, and no more than six credits of CPSC 4820 may be applied. Up to three credits of approved ECE 3000-level or higher courses; or MATH 3650; or MATH 4000-level courses may be substituted.
10Select from FIN 3060 and MGT 3900, 4000.
11Select from MGT 4520, 4540, 4550, 4560, or any 4000-level CPSC course. CPSC 4810 may not substitute.

Notes:
1. For graduation, a candidate for the BS degree in Computer Information Systems must have earned a grade of C or better in each CPSC course applied to the non-elective requirements of the degree.
2. A grade of C or better must be earned in all prerequisite courses (including CPSC and MATH courses) before enrolling in the next CPSC course.
3. General Education Cross-Cultural Awareness and Science and Technology in Society requirements must be satisfied.

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

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

Second Semester
3 - MGT 3120 Decision Models for Management
3 - MKT 3010 Principles of Marketing
3 - Business Requirement
3 - Computer Science Requirement
3 - Information Systems Requirement
15

122 Total Semester Hours

1See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.
2Four semesters (through 2020) of the same modern foreign language are required.
3See advisor.
3.4 and be admitted to the Graduate School prior to registering for graduate courses. Details of the suggested curriculum and program information are available from the Department.

**Freshman Year**

**First Semester**
- 4 - CPSC 1010 Computer Science I
- 3 - ENGL 1030 Accelerated Composition
- 4 - MATH 1060 Calculus of One Variable I
- 4 - Natural Science Requirement

**Second Semester**
- 4 - CPSC 1020 Computer Science II
- 4 - MATH 1080 Calculus of One Variable II
- 3 - Arts and Humanities (Non-Lit.) Requirement
- 3 - Natural Science Requirement

**Sophomore Year**

**First Semester**
- 3 - CPSC 2070 Discrete Structures for Computing
- 4 - CPSC 2120 Algorithms and Data Structures
- 3 - Arts and Humanities (Literature) Requirement
- 3 - Natural Science Requirement
- 3 - Oral Communication Requirement

**Second Semester**
- 3 - CPSC 2150 Software Development Foundations
- 4 - CPSC 2310 Intro to Computer Organization
- 1 - CPSC 2910 Seminar in Professional Issues I
- 3 - STAT 3090 Introductory Business Statistics
- 3 - Natural Science Requirement
- 2 - Elective

**Junior Year**

**First Semester**
- 3 - CPSC 3300 Computer Systems Organization
- 3 - CPSC 3600 Networks and Network Program.
- 3 - CPSC 3720 Intro to Software Engineering
- 3 - MATH 3110 Linear Algebra
- 3 - Social Science Requirement

**Second Semester**
- 3 - CPSC 3220 Introduction to Operating Systems
- 3 - CPSC 3500 Foundations of Computer Science
- 3 - CPSC 3620 Distributed and Cluster Computing
- 3 - Arts and Humanities Requirement or
  - 3 - Social Science Requirement
- 3 - Social Science Requirement

**Senior Year**

**First Semester**
- 3 - CPSC 3520 Programming Languages
- 6 - Computer Science Requirement
- 3 - Writing Requirement
- 3 - Elective

**Second Semester**
- 3 - CPSC 4910 Seminar in Professional Issues II
- 3 - Arts and Humanities Requirement or
  - 3 - Social Science Requirement
- 3 - Computer Science Requirement
- 3 - Elective

**Freshman Year**

**First Semester**
- 4 - CPSC 1010 Computer Science I
- 3 - ENGL 1030 Accelerated Composition
- 4 - MATH 1060 Intro. to Mathematics: Analysis or
  - 4 - MATH 1060 Calculus of One Variable I
- 4 - Foreign Language Requirement
- 1 - Elective

**Second Semester**
- 4 - CPSC 1020 Computer Science II
- 3 - MATH 2070 Multivariable Calculus or
  - 4 - MATH 1080 Calculus of One Variable II
- 3 - Arts and Humanities (Non-Lit.) Req.
- 4 - Foreign Language Requirement
- 1 - Elective

**Sophomore Year**

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

**Second Semester**
- 3 - CPSC 2150 Software Development Foundations
- 4 - CPSC 2310 Intro. to Computer Organization
- 1 - CPSC 2910 Seminar in Professional Issues I
- 3 - Foreign Language Requirement
- 4 - Natural Science Requirement

**Junior Year**

**First Semester**
- 6 - Computer Science Requirement
- 3 - Mathematical Sciences Requirement
- 3 -Minor Requirement
- 3 - Natural Science Requirement

**Second Semester**
- 3 - Computer Science Requirement
- 6 - Minor Requirement
- 3 - Social Science Requirement
- 3 - Writing Requirement

**Senior Year**

**First Semester**
- 6 - Computer Science Requirement
- 3 - Departmental Humanities Requirement
- 3 - Minor Requirement
- 3 - Social Science Requirement

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

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

**COMPUTER SCIENCE**

**Bachelor of Arts**

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

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

**Freshman Year**

**First Semester**
- 4 - CPSC 1010 Computer Science I
- 3 - ENGL 1030 Accelerated Composition
- 4 - MATH 1060 Intro. to Mathematics: Analysis or
  - 4 - MATH 1060 Calculus of One Variable I
- 4 - Foreign Language Requirement
- 1 - Elective

**Second Semester**
- 4 - CPSC 1020 Computer Science II
- 3 - MATH 2070 Multivariable Calculus or
  - 4 - MATH 1080 Calculus of One Variable II
- 3 - Arts and Humanities (Non-Lit.) Req.
- 4 - Foreign Language Requirement
- 1 - Elective

**Sophomore Year**

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

**Second Semester**
- 3 - CPSC 2150 Software Development Foundations
- 4 - CPSC 2310 Intro. to Computer Organization
- 1 - CPSC 2910 Seminar in Professional Issues I
- 3 - Foreign Language Requirement
- 4 - Natural Science Requirement

Notes:
1. For graduation, a candidate for the BS degree in Computer Science must have earned a grade of C or better in each CPSC course applied to the nonselective requirements of the degree. A grade of C or better must be earned in all prerequisite courses (including CPSC and MATH courses) before enrolling in the next CPSC course.
2. General Education Cross-Cultural Awareness and Science and Technology in Society requirements must be satisfied.
Take one or more courses that provide them with observation, computation, synthesis, communication and problem solving. Because Geology is inherently quantitative, students progress through the program they have for a variety of career paths in the geosciences. As with the topics, technologies, and resources needed to achieve these goals, the program has been carefully designed to help students develop quantitative career goals. The program has been carefully designed to help students develop quantitative and critical thinking skills, while providing opportunities for hands-on experience conducting geologic research and solving real-world problems in their chosen area of interest. It is also possible for students to pursue the Engineering Cluster Minor; students interested in this pathway should consult with their advisor early in their program of study.

Within the Geology curriculum, students who are particularly interested in environmental or water resources issues may choose to specialize in the Environmental Science Concentration or the Hydrogeology Concentration. These two concentrations provide structure and depth of coursework through the curriculum and help prepare students for careers in these specific areas. The Environmental Science Concentration in Geology focuses on environmental aspects of geoscience and is well suited for students interested in topics such as environmental policy, natural hazard assessment and remediation, evaluation of land use impacts, understanding geochemical cycles, and environmental systems analysis. This concentration provides a rigorous background in the sciences so that students can scientifically address environmental issues and integrate material from several fields to solve complex environmental problems. The Hydrogeology Concentration in Geology is designed for students who want to specialize in areas such as surface- and ground-water systems, treatment of water and cleanup of contaminated sites, contaminant flow and transport, and water resource sustainability.

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

Second Semester
4 - CH 1020 General Chemistry
3 - GEOL 1120 Earth Resources
4 - MATH 1080 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement
3 - Social Science Requirement
17

Sophomore Year
First Semester
3 - GEOL 2050 Mineralogy and Intro. Petrology
1 - GEOL 2070 Mineralogy and Intro. Petrology Lab.
1 - GEOL 2910 Introduction to Research I
2 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities (Literature) Requirement
3 - Social Science Requirement
3 - STEM Requirement
17

Second Semester
4 - GEOL 2920 Introduction to Research II
3 - Quantitative Science Requirement
3 - STEM Requirement
15

Junior Year
First Semester
4 - GEOL 3020 Structural Geology
2 - GEOL 3910 Research Methods I
3 - Quantitative Science Requirement
3 - STEM Requirement
12
Second Semester
2 - GEOL 3920 Research Methods II
7 - Geology Requirement
3 - STEM Requirement
12

Summer
6 - Field Experience

Senior Year
First Semester
3 - GEOL 4910 Research Synthesis I
4 - Geology Requirement
6 - STEM Requirement
13
Second Semester
3 - GEOL 4920 Research Synthesis II
4 - Geology Requirement
6 - STEM Requirement
13
120 Total Semester Hours

Notes:
1. For graduation, a candidate for the BA degree in Computer Science must have earned a grade of C or better in each CPSC course applied to the non-elective requirements for the degree.
2. A grade of C or better must be earned in all prerequisite courses (including CPSC and MATH courses) before enrolling in the next CPSC course.
3. General Education Cross-Cultural Awareness and Science and Technology in Society requirements must be satisfied.

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

ENVIRONMENTAL SCIENCE CONCENTRATION

Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
3 - GEOL 1010 Physical Geology
1 - GEOL 1030 Physical Geology Lab.
4 - MATH 1060 Calculus of One Variable I
15
Second Semester
6 - STEM Requirement
4 - Geology Requirement
3 - GEOL 3910 Research Methods I
3 - Quantitative Science Requirement
2 - GEOL 3920 Research Methods II
3 - Arts and Humanities (Non-Lit.) Requirement
3 - Social Science Requirement
17

Sophomore Year
First Semester
3 - GEOL 2050 Mineralogy and Intro. Petrology
1 - GEOL 2070 Mineralogy and Intro. Petrology Lab.
1 - GEOL 2910 Introduction to Research I
2 - PHYS 1220 Physics with Calculus I
3 - Arts and Humanities (Literature) Requirement
3 - Social Science Requirement
3 - STEM Requirement
17
Second Semester
4 - GEOL 2920 Introduction to Research II
3 - Quantitative Science Requirement
3 - STEM Requirement
15

Junior Year
First Semester
4 - GEOL 3020 Structural Geology
2 - GEOL 3910 Research Methods I
3 - Quantitative Science Requirement
3 - STEM Requirement
12
Second Semester
2 - GEOL 3920 Research Methods II
7 - Geology Requirement
3 - STEM Requirement
12

Summer
6 - Field Experience

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

See General Education Requirements. Two of these credit hours must also satisfy STEM requirement hours.

Second Semester
3 - GEOL 4910 Research Synthesis II
4 - Geology Requirement
6 - STEM Requirement
13
Second Semester
3 - GEOL 4920 Research Synthesis II
4 - Geology Requirement
6 - STEM Requirement
13
120 Total Semester Hours

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

Twenty-eight credit hours selected from department-approved list. No more than 14 hours below the 3000-level and no more than eight hours below the 2000-level. Courses may not be used to satisfy any other requirement.

Select from minimum requirements. Courses may not be used to satisfy any other requirement.

Fifteen credit hours. Select from GEOL 3130, 3180, 4050, 4090, 4150, 4210, or (CE) 4820. Only excess hours may be used to satisfy STEM requirement hours.

13 - GEOL 4750, or other six-credit summer geology field camp, or a combination of GEOL 2750 plus a three-credit field course in geology or other approved discipline. Students desiring to become registered professional geologists should take a six-credit summer field camp in geology/hydrogeology.
Sophomore Year
First Semester
3 - BIOL 1030 General Biology I
1 - BIOL 1050 General Biology Lab. I
3 - ENSP 2000 Intro. to Environmental Science
3 - GEOL 2050 Mineralogy and Intro. Petrology
1 - GEOL 2070 Mineral. and Intro. Petrology Lab.
1 - GEOL 2910 Introduction to Research I
3 - Arts and Humanities (Literature) Requirement¹
15
Second Semester
3 - BIOL 1040 General Biology II
1 - BIOL 1060 General Biology Lab. II
3 - CH 2010 Survey of Organic Chemistry or
3 - CH 2230 Organic Chemistry
4 - GEOL 2020 Earth History
1 - GEOL 2920 Introduction to Research II
3 - PHYS 1220 Physics with Calculus I
15
Junior Year
First Semester
3 - GEOL 3000 Environmental Geology
4 - GEOL 3020 Structural Geology
2 - GEOL 3910 Research Methods I
4 - GEOL 4150 Analysis of Geological Processes²
13
Second Semester
3 - GEOL 3180 Introduction to Geochemistry
2 - GEOL 3920 Research Methods II
3 - GEOL 4210 GIS Applications in Geology
3 - MATH 3020 Statistics for Science and Engr.
or
3 - STAT 2300 Statistical Methods I
4 - Environmental Science Requirement¹
15
Summer
6 - Field Experience⁴
Senior Year
First Semester
3 - ENSP 4000 Studies in Environmental Science
3 - GEOL (CE) 4820 Groundwater and Contaminant Transport
3 - GEOL 4910 Research Synthesis I
3 - Social Science Requirement¹
12
Second Semester
3 - GEOL 4920 Research Synthesis II
10 - Environmental Science Requirement¹
13
121 Total Semester Hours
¹See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Requirement.
²MATH 2060 may be substituted.
³Total of 14 credit hours selected from department approved list. No more than eight hours below the 3000 level. Courses cannot be used to satisfy any other requirement.
⁴GEOL 4750 or a combination of GEOL 2750 plus a three credit hour field course in geology, ecology or other approved discipline. Students desiring to become registered professional geologists should take a six credit hour summer field camp in geology/hydrogeology.

HYDROGEOLOGY
CONCENTRATION
Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
3 - GEOL 1010 Physical Geology
1 - GEOL 1030 Physical Geology Lab.
4 - MATH 1060 Calculus of One Variable I
15
Second Semester
4 - CH 1020 General Chemistry
3 - GEOL 1120 Earth Resources
4 - MATH 1080 Calculus of One Variable II
3 - Arts and Humanities (Non-Lit.) Requirement¹
3 - Social Science Requirement¹
17
Sophomore Year
First Semester
3 - GEOL 2050 Mineralogy and Intro. Petrology
1 - GEOL 2070 Mineral. and Intro. Petrology Lab.
1 - GEOL 2910 Introduction to Research I
3 - PHYS 1220 Physics with Calculus I
1 - PHYS 1240 Physics Lab I
3 - Environmental Science Requirement¹
15
Second Semester
4 - GEOL 2020 Earth History
1 - GEOL 2920 Introduction to Research II
3 - MATH 3020 Statistics for Science and Engr.
or
3 - STAT 2300 Statistical Methods I
3 - PHYS 2210 Physics with Calculus II
3 - Social Science Requirement¹
3 - Hydrogeology Requirement²
17
Junior Year
First Semester
3 - GEOL 3000 Environmental Geology
4 - GEOL 3020 Structural Geology
2 - GEOL 3910 Research Methods I
4 - GEOL 4150 Analysis of Geological Processes¹
13
Second Semester
4 - GEOL 3180 Introduction to Geochemistry
2 - GEOL 3920 Research Methods II
3 - GEOL 4210 GIS Applications in Geology
3 - MATH 3020 Statistics for Science and Engr.
or
3 - STAT 2300 Statistical Methods I
3 - PHYS 2210 Physics with Calculus II
3 - Social Science Requirement¹
3 - Hydrogeology Requirement²
17
Summer
6 - GEOL 4750 Summer Geology Field Camp
Senior Year
First Semester
3 - GEOL (CE) 4820 Groundwater and Contaminant Transport
3 - GEOL 4910 Research Synthesis I
6 - Hydrogeology Requirement²
12
Second Semester
3 - EES 4010 Environmental Engineering
4 - GEOL 4050 Surficial Geology
4 - GEOL 4090 Environmental and Exploration Geophysics
3 - GEOL 4920 Research Synthesis II
14
121 Total Semester Hours
¹See General Education Requirements. Three of these credit hours must also satisfy the Cross-Cultural Awareness Requirement.
²Total of 12 credit hours selected from department-approved list. Courses may not be used to satisfy any other requirement.
³MATH 2060 may be substituted.

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

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

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

Combined Bachelor’s/Master’s Plan
Under this plan, students may reduce the time necessary to earn both degrees by applying up to 12 graduate credits to both undergraduate and graduate program requirements. Students are encouraged to obtain the specific requirements for pursuing the combined degree from the Department of Mathematical Sciences www.clemson.edu/ces/departments/math as early as possible in their undergraduate program. Enrollment guidelines and procedures can be found under Academic Regulations in this catalog.
Bachelor of Science
Freshman Year
First Semester
3 - ENGL 1030 Accelerated Composition
4 - MATH 1060 Calculus of One Variable I
3 - Arts and Humanities (Non-Lit.) Requirement¹
3 - Foreign Language Requirement²
3 - Social Science Requirement³
16
Second Semester
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 1220 Physics with Calculus I
3 - Computer Science Requirement⁴
3 - Cross-Cultural Awareness Requirement¹
3 - Social Science Requirement³
16
Sophomore Year
First Semester
4 - MATH 2060 Calculus of Several Variables
1 - MATH 2500 Intro. to Mathematical Sciences
3 - MATH 3190 Introduction to Proof
1 - MATH 2500 Intro. to Mathematical Sciences
4 - Natural Science Requirement⁵
3 - Arts and Humanities (Literature) Requirement⁴
3 - MATH 3600 Intermediate Math. Computing
1 - MATH 2500 Intro. to Mathematical Sciences
15
Second Semester
4 - MATH 2080 Intro. to Ordinary Diff. Equations
3 - MATH 3020 Statistics for Science and Engr.
3 - MATH 3110 Linear Algebra
4 - Natural Science Requirement⁵
3 - Arts and Humanities (Non-Lit.) Requirement⁴
3 - MATH 3190 Introduction to Proof
1 - MATH 2500 Intro. to Mathematical Sciences
17
Junior Year
First Semester
3 - MATH 4000 Theory of Probability
3 - MATH 4400 Linear Programming
3 - MATH 4530 Advanced Calculus I
3 - Advanced Writing Requirement⁶
3 - Technical Requirement⁷
15
Second Semester
3 - MATH 4120 Introduction to Modern Algebra
3 - MATH 4540 Advanced Calculus II
3 - Emphasis Area Requirement⁸
3 - Technical Requirement⁷
3 - Elective
15
Senior Year
First Semester
3 - Capstone Experience⁹
6 - Emphasis Area Requirement⁸
3 - Oral Communication Requirement¹
3 - Science and Tech. in Society Requirement¹
15
Second Semester
1 - MATH 4920 Professional Development
3 - Capstone Experience⁹
3 - Emphasis Area Requirement⁸
3 - Mathematical Sciences Requirement¹⁰
3 - Elective
13
122 Total Semester Hours

¹See General Education Requirements.
²Three credits in any foreign language, including American Sign Language, numbered 1020 or above.
³See General Education Requirements. ECON 2110 is recommended for students who have not completed ECON 2110.
⁴ACTUS/FCM: See below.
⁵A two-semester sequence selected from the list of Natural Science with Laboratory General Education Requirements.
⁶ENGL 3040, 3120, 3140 or 3150; or the cluster of courses AS 3090, 3100, 4090 and 4100; or the cluster of courses ML 3010, 3020, 4010, and 4020. ENGL 3140 is recommended.
⁷A two-semester sequence selected from the list of Natural Science with Laboratory General Education Requirements.
⁹May be satisfied by (1) completion of six credits of MATH 4820; (2) completion of six credits of MATH 4910 on an approved substitution; or (3) completion of three credits of MATH 4500 and three credits of an additional course approved by the advisor. Students in Actuarial Science/Financial Mathematics Emphasis Area must have a grade of C or better in all required MATH courses. Students in the Operations Research/Management Science Emphasis Area must have a grade of C or better in all required MATH courses.
¹⁰A grade of C or better must be earned in all prerequisite courses before enrolling in the next MATH course.
¹¹Students who change majors to Mathematical Sciences will be required to have a 2.0 or higher cumulative grade-point average in all required MATH courses.
¹²Any 4000-level MATH or STAT course approved by the advisor.

EMPHASIS AREAS
Abstract Mathematics¹
6 - Abstract Mathematics Requirement²
6 - Mathematical Sciences Requirement¹
12
Actuarial Science/Financial Mathematics³
3 - ACCT 2010 Financial Accounting Concepts
1 - ACCT 2040 Accounting Procedures
3 - FIN 3120 Financial Management II
3 - MATH 4030 Intro. to Statistical Theory
3 - MATH 4310 Theory of Interest
13
Applied and Computational Mathematics
3 - MATH 4340 Advanced Engineering Math.
3 - MATH 4600 Intro. to Numerical Analysis I
6 - Applications Area¹
12
Computer Science
3 - CPSC 2150 Software Development Foundations
9 - Computer Science 3000-Level Requirement³
12
Operations Research/Management Science
3 - IE 3860 Production Planning and Control
4 - IE 4820 Systems Modeling
3 - MATH 4410 Intro. to Stochastic Models
3 - STAT 4020 Statistical Computing
13

Statistics
3 - MATH 4020 Statistical Theory and Meth. II
3 - MATH 4030 Intro. to Statistical Theory
3 - MATH 4060 Sampling Theory and Methods
3 - STAT 4020 Statistical Computing
12

BIOLOGY CONCENTRATION
Freshman Year
First Semester
5 - BIOL 1100 Principles of Biology I
3 - ENGL 1030 Accelerated Composition
3 - MATH 1060 Calculus of One Variable I
3 - Foreign Language Requirement¹
15
Second Semester
5 - BIOL 1110 Principles of Biology II
4 - MATH 1080 Calculus of One Variable II
3 - Computer Science Requirement²
3 - Social Science Requirement³
15
Sophomore Year
First Semester
4 - CH 1010 General Chemistry
4 - MATH 2060 Calculus of Several Variables
1 - MATH 2500 Intro. to Mathematical Sciences
3 - PHYS 2070 General Physics I
1 - PHYS 2090 General Physics I Lab.
3 - Arts and Humanities (Non-Lit.) Requirement⁴
16
Second Semester
4 - CH 1020 General Chemistry
4 - MATH 2080 Intro. to Ordinary Diff. Equations
3 - MATH 3110 Linear Algebra
3 - PHYS 2080 General Physics II
1 - PHYS 2100 General Physics II Lab.
15
Junior Year
First Semester
3 - CH 2230 Organic Chemistry
1 - CH 2270 Organic Chemistry Lab.
3 - MATH 3190 Introduction to Proof
3 - MATH 3600 Intermediate Math. Computing
3 - Advanced Writing Requirement¹
3 - Arts and Humanities (Literature) Requirement⁴
16
Second Semester
3 - CH 2240 Organic Chemistry
1 - CH 2280 Organic Chemistry Lab.
3 - MATH 3020 Statistics for Science and Engr.
3 - MATH 4400 Linear Programming
3 - Mathematical Sciences Requirement⁶
3 - Oral Communication Requirement⁷
16
Senior Year
First Semester
3 - MATH 4000 Theory of Probability
3 - MATH 4530 Advanced Calculus I
3 - Animal or Plant Diversity Requirement8
3 - Capstone Experience4
3 - Social Science Requirement4
121 Total Semester Hours
3Three credits in any foreign language, including American Sign Language, numbered 1020 or above
8See advisor.
9See page 113 for approved minors.

Second Semester
3 - MATH 4120 Introduction to Modern Algebra
3 - MATH 4540 Advanced Calculus II
1 - Biological Sciences Requirement10
3 - Capstone Experience5
110
10Any 4000-level MATH or STAT course approved by advisor.
11Any 4000-level MATH or STAT course approved by advisor.

Sophomore Year
First Semester
4 - MATH 2060 Calculus of Several Variables
1 - MATH 2500 Intro. to Mathematical Sciences
3 - Arts and Humanities (Literature) Requirement4
3 - Cross-Cultural Awareness Requirement4
14
Second Semester
4 - MATH 2080 Intro. to Ordinary Diff. Equations
3 - MATH 3020 Statistics for Science and Engr.
3 - MATH 3110 Linear Algebra
3 - Arts and Humanities (Non-Lit.) Requirement4
3 - Minor Requirement6 or 3 - Second Major Requirement
16
Junior Year
First Semester
3 - MATH 3190 Introduction to Proof
3 - Advanced Writing Requirement6
3 - Math Science Requirement4
4 - Natural Science Requirement4
3 - Elective
Second Semester
3 - COMM 2500 Public Speaking
3 - MATH 4120 Introduction to Modern Algebra
3 - Minor Requirement6 or 3 - Second Major Requirement
4 - Natural Science Requirement4
3 - Elective
16
Senior Year
First Semester
3 - MATH 4530 Advanced Calculus I
3 - Arts and Humanities Requirement4 or 3 - Education Requirement4
3 - Capstone Experience4
3 - Minor Requirement6 or 3 - Second Major Requirement
3 - Math Science Requirement4
15
Second Semester
1 - MATH 4920 Professional Development or 1 - EDF 4250 Instructional Tech. Strategies
3 - Capstone Experience4
6 - Minor Requirement6 or 6 - Second Major Requirement
2 - Elective
15
122 Total Semester Hours
2. A grade of C or better must be earned in all prerequisite courses before enrolling in the next MATH course.
3. Students who change majors to Mathematical Sciences must have achieved the Minimum Cumulative Grade-Point Average (MCGPA) by Total Credit Hour Level as defined in the Academic Regulations section of the Undergraduate Announcements and must have received a grade of C or better in all MATH courses taken.
4. May be satisfied by (1) completion of six credits of MATH 4820; (2) completion of six credits of MATH 4910 or an approved substitution; (3) completion of three credits of MATH 4500 and three credits of an additional course approved by advisor; or (4) EDSC 4460 for students seeking a double major in Secondary Education–Mathematics.

Notes:
1. For graduation, a candidate for the BA degree in Mathematical Sciences will be required to have a 2.0 or higher cumulative grade-point average in all required MATH courses.
2. A grade of C or better must be earned in all prerequisite courses before enrolling in the next MATH course.
3. Students who change majors to Mathematical Sciences must have achieved the Minimum Cumulative Grade-Point Average (MCGPA) by Total Credit Hour Level as defined in the Academic Regulations section of the Undergraduate Announcements and must have received a grade of C or better in all MATH courses taken.

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

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

Freshman Year
First Semester
4 - CH 1010 General Chemistry
3 - ENGL 1030 Accelerated Composition
4 - MATH 1060 Calculus of One Variable I
3 - PHYS 1220 Physics with Calculus I
1 - PHYS 1240 Physics Lab I
15
Second Semester
4 - CH 1020 General Chemistry
4 - MATH 1060 Calculus of One Variable II
3 - PHYS 2210 Physics with Calculus II
1 - PHYS 2230 Physics Lab II
3 - Arts and Humanities (Non-Lit.) Requirement4
15

Sophomore Year
First Semester
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2220 Physics with Calculus III
2 - PHYS 3000 Introduction to Research
3 - PHYS 3250 Experimental Physics I
4 - Foreign Language Requirement7
16
Second Semester
4 - MATH 2080 Intro. to Ordinary Diff. Equations
3 - PHYS 3110 Intro. to Meth. of Theoretical Phys.
3 - PHYS 3260 Experimental Physics II
4 - Foreign Language Requirement¹
1 - Elective
15

Junior Year
First Semester
3 - PHYS 3120 Methods to Theoretical Physics II
3 - PHYS 3150 Intro. to Computational Physics
3 - PHYS 3210 Mechanics I
3 - Emphasis Area Requirement¹
3 - Oral Communication Requirement¹
15

Second Semester
3 - PHYS 3220 Mechanics II
3 - PHYS 4650 Thermodynamics and Statistical Mechanics
3 - Emphasis Area Requirement¹
3 - Physics Writing Requirement¹
3 - Science Requirement¹
15

Senior Year
First Semester
3 - PHYS 4010 Senior Thesis
3 - PHYS 4410 Electromagnetics I
3 - PHYS 4550 Quantum Physics I
3 - Arts and Humanities (Literature) Requirement¹
3 - Emphasis Area Requirement¹
15

Second Semester
3 - HIST 1720 The West and the World I or
3 - HIST 1730 The West and the World II
3 - PHYS 4420 Electromagnetics II
3 - PHYS 4560 Quantum Physics II
3 - Emphasis Area Requirement¹
3 - Social Science Requirement¹
15

121 Total Semester Hours

¹See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.
²Two semesters (through 1020) in same modern foreign language are required.
³See advisor. Select from the following emphasis areas: Chemistry, Computer Science, Engineering, Environmental Engineering, Geology, Mathematical Sciences, or Physics and Astronomy. Twelve credit hours in one of these areas, with at least six at the 3000–4000 level, are required. Note: Requirements for a minor in one of these areas might be satisfied with three additional credits at the 3000–4000 level.
⁴ENGL 3040, 3120, 3140, 3150, 3160, 3450, 3460, 3480, ML 4020, or THEA (ENGL) 3470
⁵Any 2000–4000 level science course

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

Second Semester
4 - CH 1020 General Chemistry
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 2210 Physics with Calculus II
1 - PHYS 2230 Physics Lab. II
3 - Arts and Humanities (Non-Lit.) Requirement¹
15

Sophomore Year
First Semester
5 - BIOL 1100 Principles of Biology
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2220 Physics with Calculus III
2 - PHYS 3000 Introduction to Research
3 - PHYS 3250 Experimental Physics I
17

Second Semester
4 - MATH 2080 Intro. to Ordinary Diff. Equations
3 - PHYS 3110 Intro. to Meth. of Theoretical Phys.
3 - PHYS 3260 Experimental Physics II or
3 - Science Requirement¹
4 - Biophysics Requirement¹
14

Junior Year
First Semester
3 - PHYS 3120 Methods to Theoretical Physics II
3 - PHYS 3150 Intro. to Computational Physics
3 - PHYS 3210 Mechanics I
3 - Biophysics Requirement¹
4 - Foreign Language Requirement¹
16

Second Semester
3 - PHYS 3220 Mechanics II
3 - PHYS 4650 Thermodynamics and Statistical Mechanics
3 - Biophysics Requirement¹
4 - Foreign Language Requirement¹
3 - Oral Communication Requirement¹
15

Senior Year
First Semester
3 - PHYS 4410 Electromagnetics I
3 - PHYS 4550 Quantum Physics I
3 - Arts and Humanities (Literature) Requirement
3 - Biophysics Requirement¹
3 - Physics Writing Requirement¹
16

Second Semester
3 - HIST 1720 The West and the World I or
3 - HIST 1730 The West and the World II
3 - PHYS 4420 Electromagnetics II
3 - PHYS 4560 Quantum Physics II
3 - Biophysics Requirement¹
3 - Social Science Requirement¹
15

123 Total Semester Hours

¹See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.
²Select from department-approved list of courses in biological sciences, chemistry, mathematical sciences, and physics. At least six credit hours must be in biological sciences.
³Two semesters (through 1020) in same modern foreign language are required.
⁴ENGL 3040, 3120, 3140, 3150, 3160, 3450, 3460, 3480, ML 4020, or THEA (ENGL) 3470
⁵Any 2000–4000 level science course

INTERDISCIPLINARY EMPHASIS AREA
Students who select the Bachelor of Science degree in Physics with an interdisciplinary emphasis supplement their study of physics with core courses in complementary fields of study. This emphasis area is an excellent option for students preparing for direct entry into the job market or for medical, law or business school. Depending on a student’s academic goals, it may also be a good option for students preparing for graduate school or for those pursuing both a major and minor or a double major. Because students choosing the interdisciplinary emphasis have a wide variety of academic and career goals, and because the interdisciplinary emphasis requirements cannot be tracked via Clemson’s degree audit system, detailed departmental advising is vital. Students, in consultation with their advisor, must select a technical or professional emphasis area subject to departmental approval no later than the end of the second semester of their sophomore year. Additionally, all potential prerequisite courses for a minor should be completed in the student’s first or second year. For additional information, please visit http://physics.clemson.edu.

Note: Student transcripts record a Bachelor of Science in Physics; the interdisciplinary emphasis area is not included on transcripts.

Freshman Year
First Semester
4 - CH 1010 General Chemistry¹
3 - ENGL 1030 Accelerated Composition
4 - MATH 1060 Calculus of One Variable I
3 - PHYS 1220 Physics with Calculus I
1 - PHYS 1240 Physics Lab I
15

Second Semester
4 - CH 1020 General Chemistry¹
4 - MATH 1080 Calculus of One Variable II
3 - PHYS 2210 Physics with Calculus II
1 - PHYS 2230 Physics Lab II
3 - Arts and Humanities (Non-Lit.) Requirement²
15

Sophomore Year
First Semester
4 - MATH 2060 Calculus of Several Variables
3 - PHYS 2220 Physics with Calculus III
2 - PHYS 3000 Introduction to Research
3 - PHYS 3250 Experimental Physics I
3 - Emphasis Area Requirement³
15
<table>
<thead>
<tr>
<th>Course</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2080 Intro. to Ordinary Diff. Equations</td>
<td>Second</td>
</tr>
<tr>
<td>PHYS 3110 Intro. to Meth. of Theoretical Phys.</td>
<td>Second</td>
</tr>
<tr>
<td>PHYS 3260 Experimental Physics II</td>
<td>Second</td>
</tr>
<tr>
<td>Emphasis Area Requirement</td>
<td>Second</td>
</tr>
<tr>
<td>Physics Writing Requirement</td>
<td>Second</td>
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<td></td>
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<tr>
<td>Students may select an approved synthesis or capstone course</td>
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<tr>
<td>Any 2000-4000-level science course in ASTR, BIOL, CH, ENSP, GEOL, PHYS, or STS. Other science courses require departmental approval.</td>
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<tr>
<td>Two semesters (through 2020) in same modern foreign language</td>
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<td>Three of these credit hours must also satisfy the Science and Technology in Society Requirement.</td>
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<tr>
<td>Forty semesters (through 2020) in the same modern foreign language are required.</td>
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<tr>
<td>Three of these credit hours must also satisfy the Science and Technology in Society Requirement.</td>
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<td></td>
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<tr>
<td>Arts and Humanities (Literature) Requirement</td>
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<tr>
<td>Emphasis Area Requirement</td>
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<tr>
<td>Elective</td>
<td>Second</td>
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<tr>
<td>Other introductory courses, such as CPSC 1010 or 1020, may be chosen with departmental approval.</td>
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<tr>
<td>See advisor. Twenty-one credit hours, with at least nine at the 3000-4000 level, are required. Courses and emphasis area must be approved by the department.</td>
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</tr>
<tr>
<td>Bachelor of Arts</td>
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<tr>
<td>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.</td>
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</tr>
<tr>
<td>Double Major in Physics/Science Teaching—Physics</td>
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</tr>
<tr>
<td>The Bachelor of Arts Degree in Physics and Science Teaching—Physics prepares students for teaching physics on the secondary school level and for graduate studies in physics. See page 128 for the curriculum.</td>
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<tr>
<td>Note: To receive a double major in Physics and Science Teaching—Physics, the student must complete a change-of-program form to declare both majors.</td>
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<tr>
<td>Freshman Year</td>
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<tr>
<td>First Semester</td>
<td></td>
</tr>
<tr>
<td>PHYS 4010 Senior Thesis</td>
<td>Second</td>
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<tr>
<td>PHYS 4410 Electromagnetics I</td>
<td>Second</td>
</tr>
<tr>
<td>PHYS 4550 Quantum Physics I</td>
<td>Second</td>
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<tr>
<td>Arts and Humanities (Literature) Requirement</td>
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</tr>
<tr>
<td>Emphasis Area Requirement</td>
<td>Second</td>
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<td>Sophomore Year</td>
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<tr>
<td>MATH 2060 Calculus of Several Variables</td>
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<td>PHYS 2220 Physics with Calculus III</td>
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<td>PHYS 3250 Experimental Physics I</td>
<td>Second</td>
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<tr>
<td>Foreign Language Requirement</td>
<td>Second</td>
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<tr>
<td>Oral Communication Requirement</td>
<td>Second</td>
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<tr>
<td>Elective</td>
<td>Second</td>
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<tr>
<td>Junior Year</td>
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<tr>
<td>First Semester</td>
<td></td>
</tr>
<tr>
<td>PHYS 3150 Intro. to Computational Physics</td>
<td>Second</td>
</tr>
<tr>
<td>PHYS 3210 Mechanics I</td>
<td>Second</td>
</tr>
<tr>
<td>Foreign Language Requirement</td>
<td>Second</td>
</tr>
<tr>
<td>Minor Requirement</td>
<td>Second</td>
</tr>
<tr>
<td>Physics Writing Requirement</td>
<td>Second</td>
</tr>
</tbody>
</table>

1. See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.
2. See advisor.
3. Any 3000- or 4000-level physics course
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
British and Irish Studies
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 Science and Policy
Equine Industry
Film Studies
Financial Management
Food Science
Forest Products
Forest Resource Management
Gender, Sexuality and Women’s Studies
Genetics
Geography
Geology
Global Politics
Great Works
History
Horticulture
Human Resource Management
International Engineering and Science
Legal Studies
Management
Management Information Systems
Mathematical Sciences
Microbiology
Military Leadership
Modern Languages
Music
Natural Resource Economics
Nonprofit Leadership
Nuclear Engineering and Radiological Sciences
Packaging Science
Pan African Studies
Park and Protected Area Management
Philosophy
Physics
Plant Pathology
Political Science
Precision Agriculture
Psychology
Public Policy
Recreational Therapy
Religion
Russian Area Studies
Science and Technology in Society
Screenwriting
Sociology
Spanish-American Area Studies
Sustainability
Theatre
Travel and Tourism
Turfgrass
Urban Forestry
Wildlife and Fisheries Biology
Women’s Leadership
Writing

See pages 40–43 for details.