APPLIED SCIENCES, B.S.

As a Carolina engineering student, you’ll build the fundamentals to become a modern problem solver. It’s your chance to explore and work with the latest future-focused solutions, materials and technologies of today—while building the fundamentals you’ll need to one day design possibilities not yet imagined. And because you’ll earn this degree while immersed in the University’s wider liberal arts environment, you gain more than excellent technical skills. You’ll also hone the creative, critical thinking and analytical skills you need to address complicated challenges that are both pressing and practical.

This program is unique collaboration between the Department of Applied Physical Sciences (APS) in the College of Arts and Sciences and the Department of Environmental Sciences and Engineering (ESE) in the Gillings School of Global Public Health. APS is the home department for the major and all students will take their foundational engineering classes in APS. For the upper level engineering tracks, students in the Materials engineering track will take classes in APS, and students in the Environmental Engineering track will take classes in ESE.

Admissions

Students may declare the Applied Sciences major as early as their first year. However, students who wish to complete the Applied Sciences major must apply for admission to the program. Admission to the university does not guarantee admission to the program.

Students will apply via a standard application that requests biographical information and an essay. The admissions committee will also seek academic records through the close of the semester, course data from required departmental courses, and any other information available on your contributions to the University community.

There are admissions deadlines each December and May. Students should apply by the Fall semester of their sophomore year at the latest. Please visit our website for more details on the application process.

Students will need to complete the following prerequisite or corequisite math and science courses during or before the semester that they apply for admission. These courses are similar to what students take for other STEM majors in the first year:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 101</td>
<td>General Descriptive Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 101L</td>
<td>Quantitative Chemistry Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus of Functions of One Variable</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 118</td>
<td>Introductory Calculus-based Mechanics and Relativity</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 105</td>
<td>English Composition and Rhetoric</td>
<td>3</td>
</tr>
</tbody>
</table>

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

1 With a grade of C or better. AP, IB, or transfer credit will be accepted according to university policies.

Advising

First-year students receive advising through the UNC Advising Office. Once admitted to the program, students will be assigned to an academic advisor who is a faculty member in the Applied Physical Sciences Department. Students in the major will need to meet with their advisor each semester to get approval for their courses at the start of the registration process.

Student Learning Objectives

Upon completion of the applied sciences (B.S.) program, students should be able to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements

In addition to the program requirements, students must

- earn a minimum final cumulative GPA of 2.000
- complete a minimum of 45 academic credit hours earned from UNC–Chapel Hill courses
- take at least half of their major core requirements (courses and credit hours) at UNC–Chapel Hill
- earn a minimum cumulative GPA of 2.000 in the major core requirements. Some programs may require higher standards for major or specific courses.

For more information, please consult the degree requirements section of the catalog (https://catalog.unc.edu/undergraduate/degree-requirements/).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPL 101</td>
<td>Exploring Engineering</td>
<td>3</td>
</tr>
<tr>
<td>APPL 110</td>
<td>Design and Making for Engineers: Developing Your Personal Design Potential</td>
<td>3</td>
</tr>
<tr>
<td>COMP 110</td>
<td>Introduction to Programming and Data Science</td>
<td>3</td>
</tr>
</tbody>
</table>
or COMP 116  Introduction to Scientific Programming
APPL 240  Electronics from Sensors to Indicators: Circuits that interact with the Physical World 4
APPL 260  Materials Science and Engineering: Living in a Material World 4
APPL 285  Engineering Fundamentals of Force, Motion, and Energy 4
APPL 385  Thermodynamics for Engineers 4

Select one of the following tracks:  15-16

Environmental Engineering Track (16 credits), see details below
Materials Engineering Track (15 credits), see details below

APPL 697  Capstone Design I (pending approval) 2
APPL 698  Capstone Design II (pending approval) 4

Additional Requirements
CHEM 101 & 101L  General Descriptive Chemistry I and Quantitative Chemistry Laboratory I H,F 4
CHEM 102 & 102L  General Descriptive Chemistry II and Quantitative Chemistry Laboratory II H,F 4
MATH 231  Calculus of Functions of One Variable I H,F 4
MATH 232  Calculus of Functions of One Variable II H,F 4
MATH 233  Calculus of Functions of Several Variables H,F 4
MATH 383 & 383L  First Course in Differential Equations and First Course in Differential Equations Laboratory H 4
PHYS 118  Introductory Calculus-based Mechanics and Relativity H,F 4
PHYS 119  Introductory Calculus-based Electromagnetism and Quanta H,F 4

Total Hours 78-79

H  Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.
F  FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

ECON 101 is recommended, but not required.

Environmental Engineering Track

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 205 &amp; 205L</td>
<td>Engineering Tools for Environmental Problem Solving and Engineering for Environmental Problem Solving: Advanced Problems Lab</td>
<td>4</td>
</tr>
</tbody>
</table>

Choose one foundational environmental engineering course: 3

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 419</td>
<td>Chemical Equilibria in Natural Waters</td>
</tr>
<tr>
<td>ENVR 421</td>
<td>Environmental Health Microbiology</td>
</tr>
<tr>
<td>ENVR 548</td>
<td>Sustainable Energy Systems</td>
</tr>
<tr>
<td>ENVR 675</td>
<td>Air Pollution, Chemistry, and Physics</td>
</tr>
</tbody>
</table>

Choose one modelling course: 3

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 451</td>
<td>Introduction to Environmental Modeling</td>
</tr>
</tbody>
</table>

ENVR 453  Groundwater Hydrology
ENVR 468  Temporal GIS and Space/Time Geostatistics for the Environment and Public Health
ENVR 635  Energy Modeling for Environment and Public Health
ENVR 730  Computational Toxicology and Exposure Science

Choose two process engineering courses. These courses can come from a combination of one or both categories: 6

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 468</td>
<td>Environmental Process Biotechnology</td>
</tr>
<tr>
<td>ENVR 755</td>
<td>Analysis of Water Resource Systems</td>
</tr>
<tr>
<td>ENVR 756</td>
<td>Physical/Chemical Treatment Processes</td>
</tr>
</tbody>
</table>

Total Hours 16

Materials Engineering Track

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPL 4--</td>
<td>Materials Characterization (pending approval)</td>
<td>3</td>
</tr>
<tr>
<td>APPL 462</td>
<td>Engineering Materials: Properties, Selection and Design</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose three advanced materials engineering courses. These courses can come from a combination of one or both categories: 9

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPL 430</td>
<td>Optoelectronics from Materials to Devices</td>
</tr>
<tr>
<td>APPL 435</td>
<td>Nanophotonics</td>
</tr>
<tr>
<td>APPL 463</td>
<td>Bioelectronic Materials</td>
</tr>
<tr>
<td>APPL 465</td>
<td>Engineering of Soft Materials: SpongeBob Squarepants and Other Squishy Things</td>
</tr>
<tr>
<td>APPL 467</td>
<td>Materials Design for Biomedicine</td>
</tr>
</tbody>
</table>

1  Electronics and optics
2  Soft materials

Sample Plan of Study

Sample plans can be used as a guide to identify the courses required to complete the major and other requirements needed for degree completion within the expected eight semesters. The actual degree plan may differ depending on the course of study selected (second major, minor, etc.). Students should meet with their academic advisor to create a degree plan that is specific and unique to their interests. The sample plans represented in this catalog are intended for first-year students entering UNC–Chapel Hill in the fall term. Some courses may not be offered every term.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-Year Foundation Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-Year Seminar or First-Year Launch (<a href="https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/">https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/</a>)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ENGL 105</td>
<td>English Composition and Rhetoric</td>
<td>3</td>
</tr>
<tr>
<td>IDST 101</td>
<td>College Thriving</td>
<td>1</td>
</tr>
<tr>
<td>Triple-I and Data Literacy (<a href="https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/">https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/</a>)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Lifetime Fitness (<a href="https://catalog.unc.edu/undergraduate/ideas-in-action/lifetime-fitness/">https://catalog.unc.edu/undergraduate/ideas-in-action/lifetime-fitness/</a>)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Major courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FALL semester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus of Functions of One Variable I H,F</td>
<td>4</td>
</tr>
</tbody>
</table>
CHEM 101 & 101L  General Descriptive Chemistry I and Quantitative Chemistry Laboratory I  4

SPRING semester
MATH 232  Calculus of Functions of One Variable II  4
PHYS 118  Introductory Calculus-based Mechanics and Relativity  4
APPL 101  Exploring Engineering  3

Hours  31

Sophomore Year
Major courses
FALL semester
CHEM 102 & 102L  General Descriptive Chemistry II and Quantitative Chemistry Laboratory II  4
PHYS 119  Introductory Calculus-based Electromagnetism and Quanta  4
APPL 110  Design and Making for Engineers: Developing Your Personal Design Potential  3
APPL 285  Engineering Fundamentals of Force, Motion, and Energy  4

SPRING semester
MATH 233  Calculus of Functions of Several Variables  4
APPL 240  Electronics from Sensors to Indicators: Circuits that Interact with the Physical World  4
APPL 260  Materials Science and Engineering: Living in a Material World  4
COMP 110  Introduction to Programming and Data Science  3

Hours  30

Junior Year
Major courses & General Education courses
FALL semester
MATH 383 & 383L  First Course in Differential Equations and First Course in Differential Equations Laboratory  4
APPL 385  Thermodynamics for Engineers  4
T1 Track Gateway  Note that T1 is 4 credit hours in the Env Eng track and 3 credit hours in the Mat Eng track  4
Gen Ed #1  3

SPRING semester
T2 Track course #2  3
T3 Track course #3  3
Gen Ed #2  3
Gen Ed #3  3
Gen Ed #4  3

Hours  30

Senior Year
Major courses, General Education courses & Electives
FALL semester
T4 Track course #4  3
APPL 697 Capstone Design I  3
Gen Ed #5  3
Gen Ed #6  3

SPRING semester
T5 Track course #5  3
APPL 698 Capstone Design II  3
Gen Ed #7  3
Elective  3
Elective  3

Hours  30

Total Hours  121

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

F FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

Department Programs
Minor
- Applied Sciences Major, B.S. (p. 1)

Graduate Programs
- Ph.D. in Materials Science (https://catalog.unc.edu/graduate/schools-departments/applied-physical-sciences/#programstext)

Contact Information
Department of Applied Physical Sciences
Visit Program Website (https://aps.unc.edu/apse-minor/)
1129 Murray Hall, CB# 3050
(919) 843-5150
Chair
Theo Dingemans
tjdatunc@email.unc.edu

Director of Undergraduate Studies
Rich Goldberg
r.goldberg@unc.edu

Director of Graduate Studies
Rene Lopez
rln@email.unc.edu