Biomedical Sciences, BS

Learning Outcomes
Graduates of the biomedical sciences program will achieve the following.

Foundational Knowledge
Comprehension of fundamental principles and concepts in the natural and social sciences.
Graduates will be able to:
- integrate across the natural and social sciences;
- apply foundational knowledge and conceptual frameworks to biomedicine;
- recognize the consequences of evolutionary history in the understanding of human biology and disease; and
- evaluate new information reported in the news and/or in scientific publications against prior knowledge.

New Discovery
Scientific reasoning and experimental process in biomedicine.
Graduates will be able to:
- perform basic laboratory procedures, including correct operation of devices;
- formulate questions about natural processes based on current knowledge;
- construct a hypothesis to guide experimental inquiry;
- design experiments, identifying variables of analysis and controls for error;
- consider appropriate strategies or technologies applicable to investigate a novel problem;
- collect, organize, summarize, and interpret data;
- analyze and evaluate experimental results to inform a hypothesis; and
- distinguish between necessary and sufficient causes.

Quantitative Skills
Mathematical reasoning and basic numeracy applied to biomedicine.
Graduates will be able to:
- perform essential mathematical operations such as unit conversions, dilutions, and molarity calculations;
- apply mathematical concepts and rules of probability to make predictions;
- select and apply appropriate statistical tests to determine the significance of experimental results; and
- use mathematical and/or statistical expressions to evaluate hypotheses with experimental data.

Information Literacy
Acquisition, analysis, and summary of published biomedical information.
Graduates will be able to:
- locate and evaluate the relevance and credibility of information from electronic and print sources;
- navigate and obtain relevant information from public databases;
- recognize and appropriately cite sources of information;
- identify questions addressed and methodologies used; and
- assess findings reported and conclusions drawn in published scientific articles.

Communication Proficiency
Written and oral presentation of biomedical information.
Graduates will be able to:
- write concise scientific reports based on findings or literature searches;
- construct visual presentations of results or findings from the scientific literature; and
- present findings or results from the literature orally with appropriate media.

Requirements
The Bachelor of Science with a major in biomedical sciences requires a minimum of 120 s.h., including at least 80–84 s.h. of work for the major. Students must maintain a grade-point average of at least 2.00 in all courses for the major and in all UI courses for the major. They also must complete the College of Liberal Arts and Sciences GE CLAS Core.

The interdisciplinary major provides an excellent foundation for medical training and for research and/or practice in the chemical, genetic, cellular, and physiological bases of human disease. The curriculum includes required and elective coursework in biochemistry and molecular biology, biology, chemistry, health and human physiology, mathematics, microbiology and immunology, physics, psychology, sociology, and statistics. Students who wish to apply transfer credit toward the major should consult their departmental advisor.

The BS with a major in biomedical sciences requires the following coursework.

Required Courses
Students complete the following coursework (65–67 s.h.).

Chemistry

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB:3120</td>
<td>Biochemistry and Molecular Biology I</td>
<td>3</td>
</tr>
<tr>
<td>BMB:3130</td>
<td>Biochemistry and Molecular Biology II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:1110</td>
<td>Principles of Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM:1120</td>
<td>Principles of Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM:2210</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:2220</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:2410</td>
<td>Organic Chemistry Laboratory</td>
<td>3</td>
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</table>

Life Sciences

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL:1411</td>
<td>Foundations of Biology</td>
<td>4</td>
</tr>
<tr>
<td>Course #</td>
<td>Title</td>
<td>Hours</td>
</tr>
<tr>
<td>---------------</td>
<td>--------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>BIOL:3373</td>
<td>Human Population Genetics and Variation</td>
<td>3</td>
</tr>
<tr>
<td>HHP:3500</td>
<td>Human Physiology</td>
<td>3</td>
</tr>
<tr>
<td>MICR:2157-MICR:2158</td>
<td>General Microbiology Laboratory (both courses should be taken in the same semester)</td>
<td>5</td>
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<tr>
<td>One of these:</td>
<td>BIOL:2211 Genes, Genomes, and the Human Condition</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BIOL:2512 Fundamental Genetics</td>
<td>4</td>
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### Mathematics

<table>
<thead>
<tr>
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<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>One of these:</td>
<td>MATH:1460 Calculus for the Biological Sciences</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>MATH:1550 Engineering Mathematics I: Single Variable Calculus</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>MATH:1850 Calculus I</td>
<td>4</td>
</tr>
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### Statistics

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<th>Title</th>
<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>This course:</td>
<td>STAT:3510 Biostatistics</td>
<td>3</td>
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### Physics

<table>
<thead>
<tr>
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<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>One of these sequences:</td>
<td>PHYS:1511 PHYS:1512 College Physics I-II</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>PHYS:1611 PHYS:1612 Introductory Physics I-II</td>
<td>8</td>
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### Social Sciences

<table>
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<th>Hours</th>
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<tr>
<td>Both of these:</td>
<td>PSY:1001 Elementary Psychology</td>
<td>3</td>
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<tr>
<td></td>
<td>SOC:1010 Introduction to Sociology</td>
<td>3-4</td>
</tr>
<tr>
<td>One of these:</td>
<td>CPH:1800 Social and Psychological Determinants of Health: Changing Behavior, Improving Health</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PSY:2130 Advanced Psychology for Pre-Medical Track</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PSY:2930 Abnormal Psychology: Health Professions</td>
<td>3</td>
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</table>

### Elective Courses

Students complete a total of 15-17 s.h. of elective coursework chosen from the following lists.

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two of these:</td>
<td>BIOL:2254 Endocrinology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BIOL:2723 Cell Biology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BIOL:3212 Bioinformatics for Beginners</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BIOL:3233 Introduction to Developmental Biology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BIOL:3244 Animal Behavior</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BIOL:3314 Genomics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BIOL:3343 Animal Physiology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MICR:3147 Immunology and Human Disease</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MICR:3159 Bacteria and Human Disease</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MICR:3168 Viruses and Human Disease</td>
<td>3</td>
</tr>
<tr>
<td>May include one of these:</td>
<td>BIOL:2753 Introduction to Neurobiology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PSY:2701 Introduction to Behavioral Neuroscience</td>
<td>4</td>
</tr>
</tbody>
</table>

### Investigative Lab

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of these:</td>
<td>BIOL:3626 Cell Biology Laboratory</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>BIOL:3245 Animal Behavior Laboratory</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>BIOL:3656 Neurobiology Laboratory</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>BIOL:3676 Evolution Lab</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>BIOL:3716 Genetics and Biotechnology Lab</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>BIOL:3736 Developmental Biology Lab</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>MICR:3165 Genetics of Bacterial Pathogens Lab and Discussion</td>
<td>3</td>
</tr>
</tbody>
</table>

### Experiential Learning

The objective of this requirement is to enrich the curriculum through efforts on a research project or other academic experience where a student pursues activities in the biomedical sciences.

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>This course:</td>
<td>BIOL:4898 Communicating Research</td>
<td>2</td>
</tr>
<tr>
<td>One of the following:</td>
<td>BIOL:3994 Introduction to Research (taken twice for 2 s.h. each)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>BIOL:4999 Honors Research in Biology (taken twice for 2 s.h. each)</td>
<td>4</td>
</tr>
<tr>
<td>An approved research course equivalent, such as HONR:4990.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Internships, paid hourly research work, or similar experiences conducted over at least two semesters</td>
<td>0-4</td>
<td></td>
</tr>
</tbody>
</table>

1 These activities may be used to satisfy the experiential learning requirement. They also may be used to fulfill the experiential learning requirement for the University of Iowa Honors Program. Students should discuss potential activities with academic advisors and, if necessary, obtain approval from the program director for a personalized plan to satisfy the requirement. A final summary of completed and in-progress experiential learning activities, including courses taken, fellowships received, appointments, presentations, and publications, among others, is required to evaluate completion.
Honors

Honors in the Major

Students majoring in biomedical sciences are encouraged to graduate with honors in the major. Honors students in the major may enroll in courses with honors sections offered by the Department of Biology and by other departments and programs. They also are advised to participate in the Iowa Center for Research by Undergraduates (ICRU) and to apply for research scholarships.

Students who earn honors in the major must maintain a cumulative University of Iowa grade-point average (GPA) of at least 3.33, as required by the College of Liberal Arts and Sciences.

To graduate with honors, students additionally must fulfill the following requirements:

• complete the requirements for a major in biomedical sciences with a GPA of at least 3.33 in all University of Iowa coursework in the major;
• complete 2 s.h. in BIOL:4898 Communicating Research;
• complete a minimum of 6 s.h. (taken over two or more semesters) in BIOL:4999 Honors Research in Biology or equivalent research credit approved by the program director;
• write a brief research proposal summarizing the background and goals of their proposed honors research;
• upon completion of their research, submit an acceptable honors thesis; and
• give an oral presentation of their research findings.

Biomedical sciences majors interested in graduating with honors in the major should contact the biomedical sciences advisor as early as possible, preferably during their sophomore or junior year, so that they may be matched with an appropriate lab. Contact the Department of Biology to learn more about honors in the major.

University of Iowa Honors Program

In addition to honors in the major, students have opportunities for honors study and activities through membership in the University of Iowa Honors Program. Visit Honors at Iowa to learn about the university's honors program.

Membership in the UI Honors Program is not required to earn honors in the biomedical sciences major.

Career Advancement

The Pomerantz Career Center offers multiple resources to help students find internships and jobs.

Academic Plans

Four-Year Graduation Plan

The following checkpoints list the minimum requirements students must complete by certain semesters in order to stay on the university's Four-Year Graduation Plan. Courses in the major are those required to complete the major; they may be offered by departments other than the major department.

Before the fifth semester begins:

- CHEM:1110 Principles of Chemistry I
- CHEM:1120 Principles of Chemistry II
- BIOL:1411 Foundations of Biology
- PSY:1001 Elementary Psychology
- SOC:1010 Introduction to Sociology
- MATH:1460 Calculus for the Biological Sciences
- BIOL:1412 Principles of Physics

Before the seventh semester begins:

- BIOL:2211 Genes, Genomes, and the Human Condition
- CHEM:2410 Organic Chemistry
- BIOL:2512 Fundamental Genetics
- CHEM:2210 Organic Chemistry I
- BIOL:2212 Principles of Chemistry
- PHY:2151 College Physics I
- PHY:2152 College Physics II
- HHP:3500 Human Physiology

Before the seventh semester begins:

- BIOL:3120 Biochemistry and Molecular Biology
- BIOL:3130 Biochemistry and Molecular Biology II
- CHEM:2410 Organic Chemistry Laboratory

During the eighth semester:

- BIOL:4999 Honors Research in Biology
- BIOL:4898 Communicating Research

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Biomedical Sciences, BS

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic Career</strong></td>
<td><strong>Any Semester</strong></td>
<td></td>
</tr>
<tr>
<td>GE CLAS Core: Sustainability</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>First Year</strong></td>
<td><strong>Any Semester</strong></td>
<td></td>
</tr>
<tr>
<td>Begin volunteering at a hospital or other healthcare facility in the first year or as early as possible.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fall</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM:1110</td>
<td>Principles of Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH:1460</td>
<td>Calculus for the Biological Sciences</td>
<td>4</td>
</tr>
<tr>
<td>ENGL:1200 or RHET:1030</td>
<td>The Interpretation of Literature or Rhetoric</td>
<td>3 - 4</td>
</tr>
<tr>
<td>SOC:1010</td>
<td>Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>CSI:1600</td>
<td>Success at Iowa</td>
<td>2</td>
</tr>
<tr>
<td><strong>Hours</strong></td>
<td></td>
<td>16-17</td>
</tr>
<tr>
<td><strong>Spring</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL:1411</td>
<td>Foundations of Biology</td>
<td>4</td>
</tr>
<tr>
<td>CHEM:1120</td>
<td>Principles of Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>ENGL:1200 or RHET:1030</td>
<td>The Interpretation of Literature or Rhetoric</td>
<td>3 - 4</td>
</tr>
<tr>
<td>PSY:1001</td>
<td>Elementary Psychology</td>
<td>3</td>
</tr>
<tr>
<td><strong>Hours</strong></td>
<td></td>
<td>14-15</td>
</tr>
<tr>
<td><strong>Second Year</strong></td>
<td><strong>Any Semester</strong></td>
<td></td>
</tr>
<tr>
<td>Shadow a professional and learn more about the field of medicine in the second or third year.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Start the search process for a research lab in the second or third year.

<table>
<thead>
<tr>
<th>Hours</th>
<th>0</th>
</tr>
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</table>

### Fall

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL:2512</td>
<td>Fundamental Genetics or Genes, Genomes, and the Human Condition</td>
<td>3 - 4</td>
</tr>
<tr>
<td>BIOL:2211</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM:2210</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS:1511</td>
<td>College Physics I</td>
<td>4</td>
</tr>
<tr>
<td>GE CLAS Core: World Languages First Level Proficiency or elective course</td>
<td></td>
<td>4 - 5</td>
</tr>
</tbody>
</table>

### Hours

<table>
<thead>
<tr>
<th>Hours</th>
<th>14-16</th>
</tr>
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</table>

### Spring

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM:2220</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>MICR:2157</td>
<td>General Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>MICR:2158</td>
<td>General Microbiology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>PHYS:1512</td>
<td>College Physics II</td>
<td>4</td>
</tr>
<tr>
<td>GE CLAS Core: World Languages Second Level Proficiency or elective course</td>
<td></td>
<td>4 - 5</td>
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### Hours

<table>
<thead>
<tr>
<th>Hours</th>
<th>16-17</th>
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</table>

### Third Year

**Any Semester**

Students should start the search process for letters of recommendation in the third or fourth year.

<table>
<thead>
<tr>
<th>Hours</th>
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</table>

### Fall

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB:3120</td>
<td>Biochemistry and Molecular Biology I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:2410</td>
<td>Organic Chemistry Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>STAT:3510</td>
<td>Biostatistics</td>
<td>3</td>
</tr>
<tr>
<td>GE CLAS Core: World Languages Third Level Proficiency or elective course</td>
<td></td>
<td>4 - 5</td>
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</table>

### Hours

<table>
<thead>
<tr>
<th>Hours</th>
<th>16-17</th>
</tr>
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</table>

### Spring

<table>
<thead>
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<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL:3373</td>
<td>Human Population Genetics and Variation</td>
<td>3</td>
</tr>
<tr>
<td>BMB:3130</td>
<td>Biochemistry and Molecular Biology II</td>
<td>3</td>
</tr>
<tr>
<td>CPH:1800 or PSY:2930 or PSY:2130</td>
<td>Social and Psychological Determinants of Health: Changing Behavior, Improving Health or Abnormal Psychology: Health Professions or Advanced Psychology for Pre-Medical Track</td>
<td>3</td>
</tr>
<tr>
<td>GE CLAS Core: World Languages Fourth Level Proficiency or elective course</td>
<td></td>
<td>4 - 5</td>
</tr>
</tbody>
</table>

### Exam: Take MCAT in spring or summer

### Hours

<table>
<thead>
<tr>
<th>Hours</th>
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</table>

### Summer

Admission Application: Apply to medical school

<table>
<thead>
<tr>
<th>Hours</th>
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</table>

### Fourth Year

**Fall**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major: elective lecture</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Major: research experience</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>GE CLAS Core: Diversity and Inclusion</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>GE CLAS Core: Historical Perspectives</td>
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<td>3</td>
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</table>

### GE CLAS Core: International and Global Issues

<table>
<thead>
<tr>
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<th>Credits</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
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### Hours

<table>
<thead>
<tr>
<th>Hours</th>
<th>14-16</th>
</tr>
</thead>
</table>

### Spring

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL:4898</td>
<td>Communicating Research</td>
<td>2</td>
</tr>
<tr>
<td>Major: elective lecture</td>
<td></td>
<td>3 - 4</td>
</tr>
<tr>
<td>Major: investigative lab</td>
<td></td>
<td>3 - 4</td>
</tr>
<tr>
<td>GE CLAS Core: Literary, Visual, and Performing Arts</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>GE CLAS Core: Values and Culture</td>
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</tbody>
</table>

### Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall)

### Hours

<table>
<thead>
<tr>
<th>Hours</th>
<th>14-16</th>
</tr>
</thead>
</table>

### Total Hours

<table>
<thead>
<tr>
<th>Total Hours</th>
<th>119-128</th>
</tr>
</thead>
</table>

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a Sustainability must be completed by choosing a course that has been approved for Sustainability AND for one of these General Education areas: Natural Sciences; Quantitative and Formal Reasoning; Social Sciences; Historical Perspectives; International and Global Issues; Literary, Visual, and Performing Arts; or Values and Culture.

b Enrollment in chemistry courses requires completion of a placement exam.

c Enrollment in math courses requires completion of a placement exam.

d Students who have completed four years of a single language in high school have satisfied the GE CLAS Core World Languages requirement. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course.

e MICR:2157 and MICR:2158 should be taken in the same semester.

f Students complete a total of 15-17 s.h. of elective coursework from approved lists of courses; see General Catalog.

g GE CLAS Core courses may be completed in any order unless used as a prerequisite for another course. Students should consult with an advisor about the best sequencing of courses.

h Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Graduation Services.