CHEMISTRY, B.S. - ENVIRONMENTAL OPTION

Millersville University Department of Chemistry offers a B.S. Chemistry degree with an option in Environmental Chemistry. The curriculum offers courses whose contents are consistent with similar programs offered elsewhere and, with electives in inorganic chemistry and biochemistry, that will satisfy the guidelines of an option in Environmental Chemistry approved by the ACS. In addition to course requirements, the curriculum includes opportunities for industrial and government internship programs related to environmental analysis, engineering, and regulation. Of more immediate promise is the interest expressed by Lancaster Laboratories in generating a student internship program with the Chemistry Department. These internships include such areas as research in sampling and instrumental analysis of many different kinds of materials, toxicity and risk assessment, field testing and monitoring, drug screening, environmental law and regulations, analysis of food products, and quality assurance in the chemical laboratory.

Major in Chemistry, BS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 188</td>
<td>Freshman Seminar in Chemistry</td>
<td>1</td>
</tr>
</tbody>
</table>

100 AND 200 LEVEL CHEMISTRY REQUIRED COURSES

A grade of C or better is required in the 100/200 level courses before proceeding to the courses for which they are pre-requisites.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 111</td>
<td>Introductory Chemistry 1 (C minimum)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 112</td>
<td>Introductory Chemistry 2 (C minimum)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 231</td>
<td>Organic Chemistry 1 (C minimum)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 232</td>
<td>Organic Chemistry 2 (C minimum)</td>
<td>4</td>
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<tr>
<td>CHEM 251</td>
<td>Inorganic Chemistry 1 (C minimum)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 265</td>
<td>Quantitative Analysis (C minimum)</td>
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300 AND 400 LEVEL CHEMISTRY REQUIRED COURSES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>CHEM 341</td>
<td>Physical Chemistry 1</td>
<td>4</td>
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<tr>
<td>CHEM 342</td>
<td>Physical Chemistry 2</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 487</td>
<td>Seminar in Chemistry 1</td>
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</tr>
<tr>
<td>CHEM 488</td>
<td>Seminar in Chemistry 2</td>
<td>0.5</td>
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<tr>
<td>Independent Study - Choose 1 hour from:</td>
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<td></td>
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<tr>
<td>CHEM 498</td>
<td>Independent Study</td>
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CHEMISTRY OPTIONS

Option in Environmental Chemistry - See separate block

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CHEM 375</td>
<td>Environmental Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 465</td>
<td>Analytical Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 476</td>
<td>Environmental Chemistry 2</td>
<td>4</td>
</tr>
<tr>
<td>Chemistry Electives - Choose 5 hours from:</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>CHEM 300</td>
<td>Co-Op Ed Experience in Chem</td>
<td></td>
</tr>
<tr>
<td>CHEM 312</td>
<td>Chemistry in Nanotechnology</td>
<td></td>
</tr>
<tr>
<td>CHEM 324</td>
<td>Plant Biochemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 326</td>
<td>Biochemistry 1</td>
<td></td>
</tr>
<tr>
<td>CHEM 327</td>
<td>Biochemistry 2</td>
<td></td>
</tr>
<tr>
<td>CHEM 328</td>
<td>Analytical Biochemistry Lab</td>
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</tr>
</tbody>
</table>

CHEM 381 | Polymer Chemistry 1                  |       |
| CHEM 391 | Advanced Laboratory 1                |       |
| CHEM 392 | Advanced Laboratory 2                |       |
| CHEM 400 | Co-Op Ed Experience in Chem          |       |
| CHEM 435 | Advanced Organic Chemistry           |       |
| CHEM 452 | Inorganic Chemistry                  |       |
| CHEM 486 | Topics in Chemistry                  |       |
| CHEM 489 | Honors Course                        |       |
| CHEM 498 | Independent Study                    |       |
| CHEM 499 | Departmental Honors                  |       |
| CHEM 500 |                                      |       |

Total Hours 34

Req Related for Chemistry, BS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>MATH 161</td>
<td>Calculus 1</td>
<td>4</td>
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<tr>
<td>MATH 163H</td>
<td>Honors Calculus 1</td>
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</tr>
<tr>
<td>MATH 211</td>
<td>Calculus 2</td>
<td>4</td>
</tr>
<tr>
<td>MATH 311</td>
<td>Calculus 3</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 231</td>
<td>Physics 1 with Calculus</td>
<td>5</td>
</tr>
<tr>
<td>PHYS 232</td>
<td>Physics 2 with Calculus</td>
<td>5</td>
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</table>

BIOLOGY COMPETENCY

General Biology

Competency may be demonstrated with credits earned for BIOL 100 through any of the following: 1) a successful score on either the national AP Biology exam or the Biology CLEP exam. 2) a passing grade for General Biology (BIOL 100) or equivalent.

Environmental Chemistry Related Directed Electives

undefined - Choose 2 of the following: 6-8

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>BIOL 211</td>
<td>Concepts of Zoology</td>
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</tr>
<tr>
<td>BIOL 221</td>
<td>Concepts of Botany</td>
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<tr>
<td>BIOL 241</td>
<td>Principles of Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOL 340</td>
<td>Prspctv in Environm Awareness</td>
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</tr>
<tr>
<td>BIOL 343</td>
<td>Principles of Ecology &amp; Evolution</td>
<td></td>
</tr>
<tr>
<td>ESCI 245</td>
<td>Environmental Meteorology</td>
<td></td>
</tr>
<tr>
<td>ESCI 322</td>
<td>Environmental Hydrology</td>
<td></td>
</tr>
<tr>
<td>ESCI 349</td>
<td>Chemistry of the Atmosphere</td>
<td></td>
</tr>
<tr>
<td>ESCI 426</td>
<td>Groundwater Resources and Contamination</td>
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<tr>
<td>GEOG 202</td>
<td>Environmental Sustainability</td>
<td></td>
</tr>
<tr>
<td>GEOG 230</td>
<td>Physical Geography</td>
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<tr>
<td>GEOG 304</td>
<td>Water Resources Management</td>
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<tr>
<td>OSEH 321</td>
<td>Environmental &amp; Industrial Hygiene I - Chemical and Biological Hazards</td>
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<tr>
<td>OSEH 422</td>
<td>Environmental &amp; Industrial Health II - Physical Hazards</td>
<td></td>
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<tr>
<td>OSEH 435</td>
<td>Environmental Health</td>
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</table>

Total Hours 17
Other relevant environmental courses may also be selected by consulting with your academic advisor and submitting an exception to graduation requirements. A related minor may be earned by completing the minor requirements that include courses from the disciplines above.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Hours</td>
<td>28-31</td>
</tr>
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</table>

**American Chemical Society Certification - Optional**

**Code**

**Title**

**Hours**

THIS BLOCK IS NOT REQUIRED FOR DEGREE COMPLETION. The following block contains courses which are required/recommended to students opting for ACS Certification. While not required, an introductory Economics course, elementary German or Russian (GERM/RUSS 101 and 102) are recommended for inclusion in the core Liberal Arts core requirements for general education. Students must take a minimum of two hours of CHEM 489, 498, or 499 (Research) under Chemistry Electives. This means you will need a total of 3 credits in CHEM 489, 498 or 499.

**REQUIRED COURSES FOR ACS CERTIFICATION**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 326</td>
<td>Biochemistry 1</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 392</td>
<td>Advanced Laboratory 2</td>
<td>1</td>
</tr>
</tbody>
</table>

Required Independent Research - Choose 3 hours from:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 489</td>
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<tr>
<td>CHEM 498</td>
<td>Independent Study</td>
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</tr>
<tr>
<td>CHEM 499</td>
<td>Departmental Honors</td>
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</table>

**RECOMMENDED COURSES FOR ACS CERTIFICATION**

<table>
<thead>
<tr>
<th>Code</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory Economics - Optional Recommended</td>
<td>0</td>
</tr>
<tr>
<td>Elementary Language German or Russian - Optional Recommended</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total Hours**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Hours</td>
<td>8</td>
</tr>
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</table>