CHEMISTRY, B.S. - ENGINEERING INSTRUMENTATION AUTOMATION OPTION

The B.S. Chemistry degree with an option in Engineering Instrumentation Automation is focused on using, controlling, and improving instruments for chemical analysis and interpreting/analyzing data. Many chemistry employment opportunities exist in analytical laboratories or graduate school where sophisticated instrumentation is used extensively. This option maintains a core chemistry curriculum and supplements the chemistry knowledge content with industrial electronics, control systems, and robotics. This option is a unique learning experience available at Millersville due to the collaboration of the Department of Chemistry and the Department of Applied Engineering Safety and Technology. Graduate of this option will be well prepared for positions where instrumentation and analysis plays a key role.

Major in Chemistry, BS

Code | Title | Hours
--- | --- | ---
CHEM 188 | Freshman Seminar in Chemistry | 1

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.

Code | Title | Hours
--- | --- | ---
CHEM 111 | Introductory Chemistry 1 (C minimum) | 4
CHEM 112 | Introductory Chemistry 2 (C minimum) | 4
CHEM 231 | Organic Chemistry 1 (C minimum) | 4
CHEM 232 | Organic Chemistry 2 (C minimum) | 4
CHEM 251 | Inorganic Chemistry 1 (C minimum) | 3
CHEM 265 | Quantitative Analysis (C minimum) | 4

300 AND 400 LEVEL CHEMISTRY REQUIRED COURSES

CHEM 341 | Physical Chemistry 1 | 4
CHEM 342 | Physical Chemistry 2 | 4
CHEM 487 | Seminar in Chemistry 1 | 0.5
CHEM 488 | Seminar in Chemistry 2 | 0.5

Independent Study - Choose 1 hour from:

CHEM 498 | Independent Study | 1

CHEMISTRY OPTIONS

Option in Engineering Instrumentation Automation - See separate block

Total Hours | 34

Option in Chemistry, Engineering Inst. Automat, BS

Code | Title | Hours
--- | --- | ---
CHEM 391 | Advanced Laboratory 1 | 1
CHEM 465 | Analytical Chemistry | 4

Chemistry Electives - Choose 8 hours from:

Code | Title | Hours
--- | --- | ---
CHEM 300 | Co-Op Ed Experience in Chem | 
CHEM 312 | Chemistry in Nanotechnology | 
CHEM 326 | Biochemistry 1 | 
CHEM 327 | Biochemistry 2 | 
CHEM 328 | Analytical Biochemistry Lab | 

American Chemical Society Certification - Optional

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

CHEM 326 | Biochemistry 1 | 4
CHEM 392 | Advanced Laboratory 2 | 1

Required Independent Research - Choose 3 hours from:

Code | Title | Hours
--- | --- | ---
CHEM 489 | Honors Course | 
CHEM 498 | Independent Study | 
CHEM 499 | Departmental Honors | 

Total Hours | 13

Req Related for Chemistry, BS

Code | Title | Hours
--- | --- | ---
MATHEMATICS
Calculus I or Honors Calculus - Choose 1 of the following: | 4-5
MATH 161 | Calculus 1 | 
MATH 163H | Honors Calculus 1 | 
MATH 211 | Calculus 2 | 4
MATH 311 | Calculus 3 | 4

PHYSICS
PHYS 231 | Physics 1 with Calculus | 5
PHYS 232 | Physics 2 with Calculus | 5

CONTROL SYSTEMS
AENG 261 | Electronic Systems | 3
AENG 325 | Power Conversion and Control | 3
AENG 425 | Industrial Robotic Systems | 3

Programmable Logic Controllers
AENG 427 | Programmable Logic Controllers | 

Total Hours | 34-35
<table>
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<th>Course</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Introductory Economics - Optional Recommended</td>
<td>0</td>
</tr>
<tr>
<td>Elementary Language German or Russian - Optional Recommended</td>
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<tr>
<td><strong>Total Hours</strong></td>
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