Computer Engineering Major - Bachelor of Science (BS)

Have you ever seen pictures of computer chips, circuit boards, wires, and wondered how these machines work? For students that enjoy math and physics, have a keen attention to detail, think logically, and enjoy a challenge, the computer engineering major at UWL might be a perfect fit.

Computer engineers develop new computer hardware systems and write the software to support these systems. Students will take classes in software development, digital and analog circuit design, hardware/software integration, and will complete a year-long senior project within a team of other well-trained computer engineering students.

Graduates will be experts in writing low-level systems software and experts in digital circuit design - subfields of computer science and electrical engineering, respectively. This new program at UWL leverages existing expertise and courses within the computer science department, as well as in the physics department. Additionally, several new courses specific to engineers will round out the curriculum.

The computer science department at UWL has an over 50 year history of delivering innovative curriculum, and their computer engineering program continues that tradition. The program includes a course sequence culminating in a senior level virtual machines offering. A virtual machine uses one computer to pose as another. Virtual machines are important because they are the backbone of the cloud, they help in making secure systems, and they make computers compatible with other systems and software. For efficient virtual machines, both hardware and software need to be finely-tuned - making this a perfect topic for computer engineers. While a few other universities have virtual machines as an elective topic, UWL is the only known undergraduate program to require topics in virtual machines - making graduates highly desirable to employers.

Nationwide, computer engineering graduates are employed in a wide variety of industries, not just at companies that research and develop computers. Automotive, aerospace, medical equipment, agriculture equipment, defense, renewable energy, home and office appliance, manufacturing automation, and many other industries employ computer engineers. Anywhere you find a computer integrated into a product, you'll find computer engineers. Computer engineers find careers in most regions of the United States, and across the world. Upon entering the field, computer engineers also enjoy salaries that are at the upper end of starting salaries for 4-year graduates in any discipline.

Major requirements

(All colleges, excluding teacher certification programs)

63 credits (96 total credits including MTH, STAT, PHY requirements)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPE 105</td>
<td>Introduction to the Computing Environment</td>
<td>1</td>
</tr>
<tr>
<td>CPE 212</td>
<td>Digital Logic</td>
<td>3</td>
</tr>
<tr>
<td>CPE 301</td>
<td>Introduction to Transient Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CPE 309</td>
<td>Systems Development</td>
<td>3</td>
</tr>
<tr>
<td>CPE 321</td>
<td>Introduction to Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>CPE 478</td>
<td>Virtual Machines</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives

Six credits from Group A

Six additional credits from Group A or Group B

**Group A electives**

- MTH 371 Numerical Methods
- PHY 332 Electrodynamics
- CS 431 Introduction to Robotics
- CS 443 Topics in Operating Systems
- CS 455 Fundamentals of Information Security
- CS 470 Parallel and Distributed Computing
- CS 471 Computer Networks
- CS 472 Internet of Things
- CPE 302 Introduction to Control Systems
- CPE 395 Independent Study
- CPE 406 Architecture of Parallel Systems
- CPE 419 Topics in Computer Engineering
- CPE 420 Digital Design
- CPE 446 ASIC Design
- CPE 463 Advanced Computer Architecture
- CPE 466 Code Generation and Optimization
- CPE 499 Research in Computer Engineering

**Group B electives**

- MTH 317 Graph Theory
- CS 115 Introduction to Python Programming
- CS 202 Introduction to Web Design
- CS 224 Introduction to Programming Language
- CS 227 Competitive Programming
- CS 341 Software Design IV: Software Engineering
- CS 342 Software Testing Techniques
- CS 353 Analysis of Algorithm Complexity
- CS 356 Software Exploitation
- CS 364 Introduction to Database Management Systems
- CS 395 Independent Study
- CS 402 Web Application Development
- CS 410 Free and Open Source Software Development
- CS 418 Mobile Application Development
- CS 419 Topics in Computer Science
- CS 421 Programming Language Concepts
- CS 442 Structures of Compilers
- CPE 449 Advances in Software Engineering
must accomplish the following:

- Complete major and minor requirements with at least a 2.00 GPA\(^1\) in each major and minor (and concentration or emphasis, if selected).
- A minimum of 30 semester credits in residence at UWL is required for graduation. (See undergraduate resident requirement ([http://catalog.uwlax.edu/undergraduate/academicpolicies/graduation/#undergraduate-residence-requirement](http://catalog.uwlax.edu/undergraduate/academicpolicies/graduation/#undergraduate-residence-requirement)).)
- Submit an application for graduation via the "Apply for Graduation" link in the WINGS Student Center as soon as the student has registered for his or her final semester or summer term in residence.
- December and winter intersession graduates should apply by May 1. May and summer graduates should apply by December 1.

\(^1\) Grade point average requirements for some programs will be considerably higher than 2.00. Re-entering students may be required to earn credits in excess of the 120 needed for graduation in any curriculum in order to replace credits earned in courses in which the content has changed substantially in recent years. Each case will be judged on its own merit.

\(^2\) The grade point average recorded at the time the degree is awarded will not be affected by future enrollment.

No degree will be awarded unless all requirements are fulfilled and recorded within 30 days after the official ending date of each term.

## Sample degree plan

Below is a sample degree plan that can be used as a guide to identify courses required to fulfill the major and other requirements needed for degree completion. A student's actual degree plan may differ depending on the course of study selected (second major, minor, etc.). Also, this sample plan assumes readiness for each course and/or major plan, and some courses may not be offered every term. Review the course descriptions or the class timetable ([http://www.uwlax.edu/Records/catalog.uwlax.edu/undergraduate/registration/](http://www.uwlax.edu/Records/catalog.uwlax.edu/undergraduate/registration/)) for course offering information.

The sample degree plans represented in this catalog are intended for first-year students entering UWL in the fall term. Students should use the Advisement Report (AR) in WINGS ([https://wings.uwlax.edu](https://wings.uwlax.edu)) and work closely with their faculty advisor(s) and college dean's office to ensure declaration and completion of all requirements in a timely manner.

### General Education Program

The general education curriculum (Gen Ed) is the common educational experience for all undergraduates at UWL. Sample degree plans include Gen Ed placeholders to ensure completion of the general education requirements. Courses may be rearranged to fit the needs or recommendations of the student's program of study. Gen Ed courses may be taken during winter term (January between the semesters) and summer to reduce the course load during regular terms (fall and spring). Students should consult with their advisor and/or the college academic services director in their college/school for assistance with course and schedule planning. Refer to the general education requirements ([http://catalog.uwlax.edu/undergraduate/generaleducation/](http://catalog.uwlax.edu/undergraduate/generaleducation/)) for more specific details.

At least 40 credits of the 120 credits required must be earned at the 300/400-level.

**Note:** New students and transfer students with 15 or fewer credits earned are required to take FYS 100 First-Year Seminar (3 cr.) during one of their first two semesters at UWL.

### Baccalaureate degree requirements

Candidates for the Bachelor of Arts or the Bachelor of Science degrees must accomplish the following:

1. Fulfill the general education requirements.
2. Complete at least one ethnic studies (diversity) course.
3. Complete the courses prescribed by the Undergraduate Curriculum Committee for the degree desired in the respective school or college.
4. Earn a minimum of 120 semester credits with at least a 2.00 cumulative GPA,\(^1,2\)
5. At least 40 credits must be earned in 300/400 level courses. Transfer courses earned or transferred at the 300/400 level apply to this requirement.

### Prerequisite courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 120</td>
<td>Software Design I</td>
<td>4</td>
</tr>
<tr>
<td>CS 220</td>
<td>Software Design II</td>
<td>4</td>
</tr>
<tr>
<td>MTH 207</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MTH 208</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MTH 308</td>
<td>Linear Algebra with Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>PHY 203</td>
<td>General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHY 204</td>
<td>General Physics II</td>
<td>4</td>
</tr>
<tr>
<td>STAT 245</td>
<td>Probability and Statistics</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total Credits:** 33

\(^1\) May substitute MTH 225 for CS 225.

\(^2\) CPE 498 Senior Capstone (2 cr.) must be taken in sequential semesters, starting in the fall.

In addition to the 63 credits, the below prerequisite courses must be taken:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 451</td>
<td>User Interface Design</td>
<td></td>
</tr>
<tr>
<td>CS 452</td>
<td>Artificial Intelligence</td>
<td></td>
</tr>
<tr>
<td>CS 453</td>
<td>Introduction to Theory of Computation</td>
<td></td>
</tr>
<tr>
<td>CS 454</td>
<td>Digital Image Processing</td>
<td></td>
</tr>
<tr>
<td>CS 456</td>
<td>Secure Software Development</td>
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</tr>
<tr>
<td>CS 464</td>
<td>Advanced Database Management Systems</td>
<td></td>
</tr>
<tr>
<td>CS 475</td>
<td>Computer Graphics and Modeling</td>
<td></td>
</tr>
<tr>
<td>CS 476</td>
<td>Data Visualization</td>
<td></td>
</tr>
<tr>
<td>CS 499</td>
<td>Research in Computer Science</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits:** 63

Students in this major are exempt from the College of Science and Health core requirements.
This sample degree plan does not establish a contractual agreement. It identifies the minimum requirements a student must successfully complete, to qualify for a degree, in a format intended to assist the student in planning their academic career. Actual degree plans may differ.

This major is exempt from the CSH College Core requirement.

**Year 1**

<table>
<thead>
<tr>
<th></th>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 207 (Gen Ed Math)</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>PHY 203 (Gen Ed Natural Lab Science)¹</td>
<td>4</td>
<td>CS 120 (Gen Ed Lang/Logical Systems)</td>
</tr>
<tr>
<td>CPE 105</td>
<td>1</td>
<td>PHY 204²</td>
</tr>
<tr>
<td>FYS 100 (Gen Ed First-Year Seminar)</td>
<td>3</td>
<td>CST 110 (Gen Ed Literacy-Oral)</td>
</tr>
<tr>
<td>ENG 110 or 112 (Gen Ed Literacy-Written)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td><strong>15</strong></td>
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</tbody>
</table>

**Year 2**

<table>
<thead>
<tr>
<th></th>
<th>Fall Credits</th>
<th>Spring Credits</th>
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</thead>
<tbody>
<tr>
<td>CS 220</td>
<td>4</td>
<td>CPE 212</td>
</tr>
<tr>
<td>CS 225³</td>
<td>3</td>
<td>CS 270</td>
</tr>
<tr>
<td>STAT 245</td>
<td>4</td>
<td>CS 340</td>
</tr>
<tr>
<td>MTH 308</td>
<td>4</td>
<td>PHY 334</td>
</tr>
<tr>
<td>Gen Ed Arts</td>
<td>2-3</td>
<td>Gen Ed Minority Cultures</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

**Year 3**

<table>
<thead>
<tr>
<th></th>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPE 301</td>
<td>3</td>
<td>CPE 321</td>
</tr>
<tr>
<td>CPE 309</td>
<td>3</td>
<td>CS 351</td>
</tr>
<tr>
<td>CS 370</td>
<td>3</td>
<td>CS 372</td>
</tr>
<tr>
<td>PHY 335</td>
<td>4</td>
<td>CS 441</td>
</tr>
<tr>
<td>Gen Ed Self &amp; Society</td>
<td>3</td>
<td>Gen Ed Health &amp; Well-Being</td>
</tr>
<tr>
<td>CPE 483</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

**Year 4**

<table>
<thead>
<tr>
<th></th>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPE Elective (Group A)</td>
<td>3</td>
<td>CPE 478</td>
</tr>
<tr>
<td>CPE Elective (Group A)</td>
<td>3</td>
<td>CPE Elective (Group A or B)</td>
</tr>
<tr>
<td>Gen Ed Arts</td>
<td>2-3</td>
<td>CPE Elective (Group A or B)</td>
</tr>
<tr>
<td>CPE 481</td>
<td>1</td>
<td>Gen Ed World History</td>
</tr>
<tr>
<td>Gen Ed Global Studies</td>
<td>3</td>
<td>Gen Ed Humanistic Studies</td>
</tr>
<tr>
<td>CPE 498⁴</td>
<td>2</td>
<td>CPE 498⁴</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

Total Credits: 127

¹ PHY 203 is only offered in the fall.
² PHY 204 is only offered in the spring.
³ May substitute MTH 225 for CS 225.
⁴ CPE 498 must be taken in sequential semesters, starting in the fall.