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>

CPE 481 Professionalism in Engineering 1
CPE 483 Engineering Project Management 1
CS 225 Discrete Computational Structures 1 3
CS 270 Introduction to Assembler Programming, C Programming and Computer Organization 3
CS 340 Software Design III: Abstract Data Types 4
CS 351 Simulation 3
CS 370 Computer Architecture 3
CS 372 Hardware/Software Integration 3
CS 441 Operating System Concepts 3
PHY 334 Electrical Circuits 3
PHY 335 Electronics 4
Capstone
CPE 498 Senior Capstone 2 4

Electives
Six credits from Group A 6
Six additional credits from Group A or Group B 6

**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
CS 449 Advances in Software Engineering
must accomplish the following:

Candidates for the Bachelor of Arts or the Bachelor of Science degrees

Baccalaureate degree requirements

Students have access to the AR.

of these requirements is to refer to the Advisement Report (AR) found

requirements in order to qualify for a degree. The easiest way to track all

All students must complete the general education, college core (waived

Degree requirements

Students in this major are exempt from the College of Science and

Health core requirements.

2

Prerequisite courses

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 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 63

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>
<td></td>
</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 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.

Students in this major are exempt from the College of Science and

Health core requirements.

Degree requirements

All students must complete the general education, college core (waived

for computer engineering majors), major/minor, and university degree

requirements in order to qualify for a degree. The easiest way to track all

of these requirements is to refer to the Advisement Report (AR) found

in the Student Information System (WINGS) Student Center. All enrolled

students have access to the AR.

• General education [http://catalog.uwlax.edu/undergraduate/
genereducation/](http://catalog.uwlax.edu/undergraduate/genereducation/)

• Baccalaureate degree requirements (p. 2)

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.

6. Complete major and minor requirements with at least a 2.00 GPA.1
   2

7. 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].)

8. 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/
registration/](http://www.uwlax.edu/Records/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/genereducation/](http://catalog.uwlax.edu/undergraduate/genereducation/)) 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.
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>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 207 (Gen Ed Math)</td>
<td>5 MTH 208 (Gen Ed Math)</td>
</tr>
<tr>
<td>PHY 203 (Gen Ed Natural Lab Science)</td>
<td>4 CS 120 (Gen Ed Lang/Logical Systems)</td>
</tr>
<tr>
<td>CPE 105</td>
<td>1 PHY 204</td>
</tr>
<tr>
<td>FYS 100 (Gen Ed First-Year Seminar)</td>
<td>3 CST 110 (Gen Ed Literacy-Oral)</td>
</tr>
<tr>
<td>ENG 110 or 112 (Gen Ed Literacy-Written)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits:</strong> 16</td>
<td>15</td>
</tr>
</tbody>
</table>

### Year 2

<table>
<thead>
<tr>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 220</td>
<td>4 CPE 212</td>
</tr>
<tr>
<td>CS 225</td>
<td>3 CS 270</td>
</tr>
<tr>
<td>STAT 245</td>
<td>4 CS 340</td>
</tr>
<tr>
<td>MTH 308</td>
<td>4 PHY 334</td>
</tr>
<tr>
<td>Gen Ed Arts</td>
<td>2-3 Gen Ed Minority Cultures</td>
</tr>
<tr>
<td><strong>Total Credits:</strong> 17</td>
<td>16</td>
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</tbody>
</table>

### Year 3

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

### Year 4

<table>
<thead>
<tr>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPE Elective (Group A)</td>
<td>3 CPE 478</td>
</tr>
<tr>
<td>CPE Elective (Group A)</td>
<td>3 CPE Elective (Group A or B)</td>
</tr>
<tr>
<td>Gen Ed Arts</td>
<td>2-3 CPE Elective (Group A or B)</td>
</tr>
<tr>
<td>CPE 481</td>
<td>1 Gen Ed World History</td>
</tr>
<tr>
<td>Gen Ed Global Studies</td>
<td>3 Gen Ed Humanistic Studies</td>
</tr>
<tr>
<td>CPE 498</td>
<td>2 CPE 498</td>
</tr>
<tr>
<td><strong>Total Credits:</strong> 14</td>
<td>17</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.