

# 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)

Code	Title	Credits
<b>Core</b>		
CPE 105	Introduction to the Computing Environment	1
CPE 212	Digital Logic	3
CPE 301	Introduction to Transient Analysis	3
CPE 309	Systems Development	3
CPE 321	Introduction to Digital Signal Processing	3
CPE 478	Virtual Machines	3

CPE 481	Professionalism in Engineering	1
CPE 483	Engineering Project Management	1
CS 225	Discrete Computational Structures <sup>1</sup>	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
<b>Capstone</b>		
CPE 498	Senior Capstone <sup>2</sup>	4
<b>Electives</b>		
Six credits from Group A		6
Six additional credits from Group A or Group B		6
<b>Group A electives</b>		
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	
<b>Group B electives</b>		
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	

CS 451	User Interface Design
CS 452	Artificial Intelligence
CS 453	Introduction to Theory of Computation
CS 454	Digital Image Processing
CS 456	Secure Software Development
CS 464	Advanced Database Management Systems
CS 475	Computer Graphics and Modeling
CS 476	Data Visualization
CS 499	Research in Computer Science
<b>Total Credits</b>	<b>63</b>

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

Code	Title	Credits
<b>Prerequisite courses</b>		
CS 120	Software Design I	4
CS 220	Software Design II	4
MTH 207	Calculus I	5
MTH 208	Calculus II	4
MTH 308	Linear Algebra with Differential Equations	4
PHY 203	General Physics I	4
PHY 204	General Physics II	4
STAT 245	Probability and Statistics	4
<b>Total Credits</b>		<b>33</b>

<sup>1</sup> May substitute MTH 225 for CS 225.

<sup>2</sup> 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/generaleducation/>)
- 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.<sup>1,2</sup>
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<sup>1,2</sup> in each major and minor (and concentration or emphasis, if selected).
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.

- <sup>1</sup> 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.
- <sup>2</sup> 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/>) 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>) 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/>) 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

Fall	Credits Spring	Credits
MTH 207 (Gen Ed Math)	5 MTH 208 (Gen Ed Math)	4
PHY 203 (Gen Ed Natural Lab Science) <sup>1</sup>	4 CS 120 (Gen Ed Lang/Logical Systems)	4
CPE 105	1 PHY 204 <sup>2</sup>	4
FYS 100 (Gen Ed First-Year Seminar)	3 CST 110 (Gen Ed Literacy-Oral)	3
ENG 110 or 112 (Gen Ed Literacy-Written)	3	
	<b>16</b>	<b>15</b>

#### Year 2

Fall	Credits Spring	Credits
CS 220	4 CPE 212	3
CS 225 <sup>3</sup>	3 CS 270	3
STAT 245	4 CS 340	4
MTH 308	4 PHY 334	3
Gen Ed Arts	2-3 Gen Ed Minority Cultures	3
	<b>17</b>	<b>16</b>

#### Year 3

Fall	Credits Spring	Credits
CPE 301	3 CPE 321	3
CPE 309	3 CS 351	3
CS 370	3 CS 372	3
PHY 335	4 CS 441	3
Gen Ed Self & Society	3 Gen Ed Health & Well-Being	3
	CPE 483	1
	<b>16</b>	<b>16</b>

#### Year 4

Fall	Credits Spring	Credits
CPE Elective (Group A)	3 CPE 478	3
CPE Elective (Group A)	3 CPE Elective (Group A or B)	3
Gen Ed Arts	2-3 CPE Elective (Group A or B)	3
CPE 481	1 Gen Ed World History	3
Gen Ed Global Studies	3 Gen Ed Humanistic Studies	3
CPE 498 <sup>4</sup>	2 CPE 498 <sup>4</sup>	2
	<b>14</b>	<b>17</b>

**Total Credits: 127**

<sup>1</sup> PHY 203 is only offered in the fall.

<sup>2</sup> PHY 204 is only offered in the spring.

<sup>3</sup> May substitute MTH 225 for CS 225.

<sup>4</sup> CPE 498 must be taken in sequential semesters, starting in the fall.