# Software Engineering- Bachelor of Science in Software Engineering

For information, contact the Department of Computer Science and Software Engineering, 262 McVey Data Science Building, 513-529-0340, or visit http://cse.MiamiOH.edu.

The software engineering major provides graduates with the foundational knowledge and practical skills necessary to develop large, complex computer software systems. The program focuses on the methodologies, techniques and tools needed to develop complex software in a multidisciplinary environment. Topics of study go beyond traditional computer science and include software design, software maintenance, and formal methods for software development. Throughout the program, students are expected to learn in a team environment and thus gain skills in effective communication. In addition to interest in analytical skills, problem solving, and an aptitude for working with technology, students are expected to develop an appreciation for teamwork.

The U.S. Bureau of Labor's job outlook for software engineering graduates is excellent, and the number of positions is expected to increase by 25% between 2021 and 2031. This employment growth is due to the demand for increasing efficiency in network technology, computing speeds, software performance, and embedded systems. The median annual earnings for software developers were $120,730 in May 2021. According to the National Association of Colleges and Employers, starting offers for graduates with a bachelor's degree in computer science average more than $72,000.

## Program Educational Objectives

Graduates from the Software Engineering program are expected to attain or achieve the following Program Educational Objectives within a few years of graduation:

- Develop in their chosen profession and/or progress toward an advanced degree

- Provide innovative solutions using technical skills in their discipline

- Communicate effectively, demonstrate leadership, and work collaboratively in diverse teams/organizations

- Act responsibly and ethically in their profession and as informed citizens

## Student Outcomes

Upon graduation, software engineering majors should be able to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

## Departmental Honors

If you excel in your studies, you may qualify for the University Honors Program or the program for Honors in Computer Science and Software Engineering. As a senior in these programs, you will have the opportunity to work closely with the faculty on research projects of interest.

## Credit/No-Credit Policy

All courses in chemistry, physics, biology, mathematics, statistics and those in the  College of Engineering and Computing (CEC, CPB, CSE, CYB, ECE, EGM, MME, QTM)  that are used to fulfill requirements of the major, must be taken for a letter grade.

## Divisional Policies

**Multiple Majors**: Students with two or more majors in the College of Engineering and Computing must take a minimum of 15 unique, additional credit hours in each major.

**Career Foundations:** The Career Foundations course sequence (CEC 190 series) is designed to equip students with the essential professional skills needed for lifelong career success. Students starting in CEC majors in fall 2025 and later are required to take CEC 190 each semester and are automatically registered. CEC 190 is zero credit hours, has a grade mode of credit/no-credit, requires 5-10 hours and awards a badge each semester. Students earn certificates for successfully completing eight badges.

For more information, visit our website at http://cse.MiamiOH.edu.

## Program Requirements

(92 semester hours)

| Code | Title | Credit Hours |
|---|---|---|
| **Core Requirements** | | |
| STC 135 | Principles of Public Speaking | 3 |
| or APC 231 | Small Group Communication | |
| or ENG/IMS 224 | Professional Communication & Digital Rhetoric | |
| Mathematics: | | |
| MTH 151 | Calculus I | 4 |
| MTH 231 | Elements of Discrete Mathematics | 3 |
| or MTH 331 | Proof: Introduction to Higher Mathematics | |
| Statistics | | |
| STA 301 | Applied Statistics | 3-4 |

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|---|---|---|
| or STA 261 | Statistics | |
| or ECE 345 | Introduction to Probability, Statistics, and Random Processes | |
| **Mathematics/Statistics Electives** | | **9-10** |
| Take three of the following: | | |
| STA 333 | Nonparametric Statistics | |
| STA 363 | Introduction to Statistical Modeling | |
| STA/ISA 365 | Statistical Monitoring and Design of Experiments | |
| STA 401 | Probability | |
| STA 402 | Statistical Programming | |
| STA 404 | Advanced Data Visualization | |
| STA 427 | Introduction to Bayesian Statistics | |
| STA 432 | Sampling Design and Analysis | |
| STA 466 | Experimental Design Methods | |
| STA 467 | Statistical Learning | |
| MTH 222 | Introduction to Linear Algebra | |
| MTH 245 | Differential Equations for Engineers | |
| MTH 246 | Linear Algebra and Differential Equations for Engineers | |
| MTH 251 | Calculus II | |
| or MTH 249 | Calculus II | |
| MTH 252 | Calculus III | |
| MTH 347 | Differential Equations | |
| MTH 411 | Foundations of Geometry | |
| MTH 421 | Introduction to Abstract Algebra | |
| MTH 432 | Optimization | |
| MTH 437 | Game Theory and Related Topics | |
| MTH 438 | Theory and Applications of Graphs | |
| MTH 439 | Combinatorics | |
| MTH 441 | Real Analysis | |
| MTH 447 | Topics in Mathematical Finance | |
| **Natural Science Electives** | | **8-10** |
| Select two of the following six options: | | |
| BIO/MBI 115 | Biological Concepts: Ecology, Evolution, Genetics, and Diversity | |
| BIO/MBI 116 | Biological Concepts: Structure, Function, Cellular, and Molecular Biology | |
| CHM 141 & CHM 144 | College Chemistry and College Chemistry Laboratory | |
| CHM 142 & CHM 145 | College Chemistry and College Chemistry Laboratory | |
| PHY 181 & PHY 183 | General Physics I and General Physics Laboratory I | |
| PHY 182 & PHY 184 | General Physics II and General Physics Laboratory II | |
| **Mathematics/Statistics/Science Elective** | | **3-5** |
| Select one additional course from one of the following: | | |
| Any of the above Mathematics/Statistics Electives | | |
| Any of the above Natural Science Electives | | |
| Any Miami Plan Natural Science | | |
| **Software Engineering Core** | | |
| CEC 111 | Imagination, Ingenuity and Impact I | 2 |

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| CEC 112 | Imagination, Ingenuity, and Impact II | 2 |
| CSE 174 | Fundamentals of Problem Solving and Programming | 3 |
| CYB 134 | Introduction to Cybersecurity | 3 |
| or CIT 258 | Introduction to Global Cybersecurity | |
| CSE 201 | Introduction to Software Engineering | 3 |
| CSE 202 | Software Requirements | 3 |
| CSE 212 | Software Engineering for User Interface and User Experience Design | 3 |
| CSE 271 | Object-Oriented Programming | 3 |
| CSE 274 | Data Abstraction and Data Structures | 3 |
| CSE 278 | Systems I: Introduction to Systems Programming | 3 |
| CSE 301 | Software Architecture and Design | 3 |
| CSE 302 | Software Construction | 3 |
| CSE 374 | Algorithms I | 3 |
| CSE 383 | Web Application Programming | 3 |
| CSE 401 | Software Quality Assurance and Testing | 3 |
| CSE 448 | Senior Design Project I | 2 |
| CSE 449 | Senior Design Project II | 2 |
| **CSE Electives (a total of 12 hours are required)** | | **12** |
| 6 to 12 hours of software engineering electives: | | |
| CSE/CYB 235 | Computer Network Design and Administration | |
| CSE 268 | Introduction to Knowledge Representation | |
| CSE 382 | Mobile App Development | |
| CSE 385 | Database Systems | |
| CSE 389 | Game Design and Implementation | |
| CSE 411 | Introduction to Model-Driven Software Engineering | |
| CSE 432 | Machine Learning | |
| CSE 444 | Applied Cryptography | |
| CSE 451 | Web Services and Service Oriented Architectures | |
| CSE 468 | Applied Knowledge Representation | |
| CSE 470 | Special Topics in CSE | |
| CSE 474 | Compiler Design | |
| CSE 485 | Advanced Database Systems | |
| CSE 489 | Advanced Graphics and Game Engine Design | |
| CYB 331 | Software Security | |
| CYB 334 | Network Security | |
| IMS 211 | Introduction to Game Studies | |
| IMS 212 | Introduction to Game Design | |
| IMS 319 | Foundations in Digital 3-D Modeling and Animation | |
| ISA 401 | Business Intelligence and Data Visualization | |
| ISA 406 | IT Project Management | |
| 0 to 6 hours of affiliate electives: | | |
| CSE 262 | Technology, Ethics, and Global Society | |
| CSE 270 | Special Topics | |

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| CSE 276 | Mathematics and Computer Science | |
| CSE 381 | Systems 2: OS, Concurrency, Virtualization, and Security | |
| CSE 386 | Foundations of Computer Graphics and Games | |
| CSE 440 | CSE Special Topics - Affiliate | |
| CSE 443 | High Performance Computing & Parallel Programming | |
| CSE 465 | Comparative Programming Languages | |
| CSE 473 | Automata, Formal Languages, and Computability | |
| CSE 486 | Introduction to Artificial Intelligence | |
| CSE 488 | Image Processing & Computer Vision | |
| CYB 234 | System Administration and Scripting for Cybersecurity | |
| CYB 236 | Data Security | |
| ECE 287 | Digital Systems Design | |
| ECE 461 | Network Performance Analysis | |
| IMS 333 | Digital Innovation and Entrepreneurship | |
| IMS 414 | Web and Social Media Analytics | |
| IMS 461 | Virtual Reality | |
| ISA 235 | Information Technology and the Intelligent Enterprise | |
| 0 to 3 hours of research electives: | | |
| CSE 340U | (requires petition) | |
| CSE 480 | Special Problems (honors Program) | |
| CSE 491 | Undergraduate Research | |
| **Total Credit Hours** | | **92-98** |