

# COMPUTER SCIENCE MAJOR (BS)

The BS program in Computer Science supports the mission of the University by providing a curriculum focusing on the most advanced practices of computer science through continued assessment by employers, alumni, faculty and students. The BS in Computer Science is accredited by the Computing Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) under the commission's General Criteria and Program Criteria for Computer Science. Students may obtain a concentration in Computer Engineering or Software Engineering.

The Program Educational Objectives (PEOs) are broad statements that describe what alumni do within a few years following graduation. The BS in Computer Science program is committed to our alumni who, within a few years of their graduation, are expected to:

1. Apply their in-depth understanding in areas of computer science and engineering to solve problems in a modern technological society as productive computer scientists or engineers and/or enter and succeed in a graduate program.
2. Function effectively, both individually and within multi-disciplinary teams.
3. Continue as lifelong learner to develop their computing and engineering abilities, problem-solving skills, and aptitude for innovation.
4. Practice professional ethics with social and cyber responsibility through service in the framework of a global technical community.

Student Outcomes:

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. Apply computer science theory and software development fundamentals to produce computing-based solutions.

The program emphasizes the complete process of developing computing-based solutions. Students learn how to gather requirements, design, develop, test, deploy, and maintain software using rigorous computing practices. They are taught how to leverage technology to create flexible and scalable applications and to address the challenges that arise during the development process. Also, the program exposes students to a range of other disciplines, such as the physical sciences, social sciences, economics, and business so they gain an understanding of the real world scenarios that make up the computer science environment. Theoretical courses are supported by rigorous laboratory tasks.

Fairfield's computer science curriculum encompasses a truly unique combination of experiences:

- **Experiential Hands-On Learning:** A unique curriculum guarantees computer science students the equivalent of 20 months of real-world experience through a sophomore year service-learning initiative, a junior year entrepreneurial experience, and an industry-based senior capstone project.
- **Cross-Disciplinary Engineering Exposure:** As part of the School of Engineering and Computing, computer science students have access to other engineering disciplines and engineering-heavy industries, which expands career opportunities exponentially.
- **Student Mentoring:** By volunteering as high school mentors, students learn valuable management skills, they become comfortable explaining highly technical concepts simply and clearly, and they experience the satisfaction of sharing their knowledge to help others.
- **Liberal Arts Core:** A strong foundation in the liberal arts encourages engineers to think critically, design imaginatively, communicate clearly and collaborate productively.
- **Academic/Research Activities and Internship:** Companies from a variety of domains, such as The Weather Company (visualization), Federal Aviation Administration (software engineering and data mining), Saugatuck Energy (artificial intelligence) have an on-campus presence and provide computer science students opportunities to interact with industry leaders.

## Major Requirements

### Bachelor of Science in Computer Science

127 credits

#### Major Requirements

For a major in Computer Science, students complete the following:

| Code  | Title   | Credits |
|---|---|---------|
| <b>Foundation Courses</b>                                   |   |         |
| CPEG 2245 & 2245L   | Digital Design I and Digital Design I Lab                               | 4       |
| CPSC 1101   | Introduction to Computing (placement based)                             | 3       |
| or ENGR 1031  | Fundamentals of Engineering   |         |
| CPSC 1131   | Fundamentals of Programming   | 3       |
| CPSC 2231 & 2231L   | Programming Workshop and Programming Workshop Lab                       | 4       |
| CPSC 2232 & 2232L   | Data Structures and Data Structures Lab                                 | 4       |
| MATH 1141   | Calculus I for Chemistry, Engineering, and Physics Majors <sup>1</sup>  | 4       |
| MATH 1142   | Calculus II for Chemistry, Engineering, and Physics Majors <sup>1</sup> | 4       |
| MATH 2231   | Discrete Mathematics  | 3       |
| Select two natural science electives with labs <sup>1</sup> |   | 8       |
| Select two elective courses in Mathematics <sup>2</sup>     |   | 6       |
| <b>Depth Courses</b>  |   |         |
| CPEG 3346   | Computer Systems Architecture   | 3       |
| CPSC 2250L  | Computer Science Sophomore Clinic                                       | 1       |
| CPSC 2304   | Web Development   | 3       |
| CPSC 3333   | Introduction to Cybersecurity   | 3       |
| CPSC 3343   | Design and Analysis of Algorithms                                       | 3       |

|  |                                   |           |
|--|-----------------------------------|-----------|
| CPSC 3351L   | Computer Science Junior Clinic I  | 1         |
| CPSC 3352L   | Computer Science Junior Clinic II | 1         |
| CPSC 3354  | Theory of Programming Languages   | 3         |
| ENGR 4961  | Senior Design Project I           | 3         |
| ENGR 4962  | Senior Design Project II          | 3         |
| SWEG 3301  | Software Engineering Methods      | 3         |
| SWEG 3302  | Software Design Methods           | 3         |
| CPSC 4331  | Operating Systems                 | 3         |
| Select one major elective from the following five courses:             |                                   | 3         |
| CPSC 4322  | Visual Analytics                  |           |
| CPSC 4355  | Artificial Intelligence           |           |
| CPSC 4357  | Database Management Systems       |           |
| CPSC 4360  | Machine Learning                  |           |
| CPSC 4521  | Information Visualization ( )     |           |
| Select a second major elective from the following two courses:         |                                   | 3         |
| CPSC 3349  | Cloud Computing                   |           |
| CPSC 4314  | Network Security                  |           |
| Select two additional major electives in Computer Science <sup>3</sup> |                                   | 6         |
| <b>Total Credits</b>   |                                   | <b>88</b> |

<sup>1</sup> Fulfills Magis Core requirement

<sup>2</sup> Math courses must be 2000 level or higher, courses are chosen under advisement of the faculty advisor and/or department chair

<sup>3</sup> Major electives are chosen from the department, under advisement of the faculty advisor and department chair

In addition to Magis Core, foundation, and depth courses, students must complete two general electives (6 credits) for the BS in Computer Science Major.

## Concentrations

Concentrations in Software Engineering and Computer Engineering are available to students majoring in Computer Science. These concentrations build on required courses in the program and require students to complete additional credits.

### Computer Engineering Concentration

| Code                                   | Title   | Credits      |
|--|---|--------------|
| CPEG 2245 & 2245L                      | Digital Design I and Digital Design I Lab                   | 4            |
| CPEG 3346                              | Computer Systems Architecture                               | 3            |
| Select two courses from the following: |   | 6-7          |
| CPEG 3246                              | Digital Electronics Design II                               |              |
| CPEG 3331                              | Biomedical Signal Processing                                |              |
| CPEG 4320<br>or CPSC 4314              | Computer Networks<br>Network Security                       |              |
| CPEG 4332                              | Biomedical Imaging  |              |
| ELEG 3348 & 3348L                      | Embedded Microcontrollers and Embedded Microcontrollers Lab |              |
| <b>Total Credits</b>                   |   | <b>13-14</b> |

### Software Engineering Concentration

| Code                   | Title   | Credits |
|------------------------|---|---------|
| SWEG 3301 & CPSC 3351L | Software Engineering Methods and Computer Science Junior Clinic I | 4       |

|                           |   |           |
|---------------------------|---|-----------|
| SWEG 3302 & CPSC 3352L    | Software Design Methods and Computer Science Junior Clinic II | 4         |
| SWEG 4320                 | Software Testing and Maintenance                              | 3         |
| SWEG 4321<br>or SWEG 4312 | Software Project Management<br>Agile Software Engineering     | 3         |
| <b>Total Credits</b>      |   | <b>14</b> |

## Magis Core Requirements

### Magis Core Relationship to the Computer Science Major

In addition to the engineering-specific major requirements, students are required to fulfill the University's *Magis* Core requirements. The following table relates the *Magis* Core requirements to the BS in Computer Science major.

#### Tier I: Orientation

| Code   | Title  | Credits   |
|--|--|-----------|
| <b>English</b>   |  |           |
| ENGL 1001  | Introduction to Rhetoric and Composition                   | 3         |
| <b>History</b>   |  |           |
| Select one HIST 1000-level course<br>or CLST 1115 or CLST 1116 |  | 3         |
| <b>Mathematics</b>   |  |           |
| MATH 1141  | Calculus I for Chemistry, Engineering, and Physics Majors  | 4         |
| <b>Modern or Classical Language</b>                            |  |           |
| Select one language course based on placement <sup>1</sup>     |  |           |
| <b>Philosophy</b>  |  |           |
| PHIL 1101  | Introduction to Philosophy                                 | 3         |
| <b>Religious Studies</b>                                       |  |           |
| Select one RLST 1000-level course                              |  | 3         |
| <b>Modern/Classical Language or Mathematics</b>                |  |           |
| MATH 1142  | Calculus II for Chemistry, Engineering, and Physics Majors | 4         |
| <b>Total Credits</b>   |  | <b>20</b> |

<sup>1</sup> If starting a new language, a placement exam is not necessary.

#### Tier II: Exploration

| Code  | Title | Credits |
|---|-------|---------|
| <b>Behavioral and Social Sciences</b>                                 |       |         |
| Select two courses from the following fields:                         |       | 6       |
| Communication   |       |         |
| Economics   |       |         |
| Politics  |       |         |
| Psychology (except PSYC 2610)   |       |         |
| Sociology and Anthropology (except ANTH 1200 and ANTH 1210)           |       |         |
| <b>History, Philosophy, Religious Studies</b>                         |       |         |
| Select two 2000- or 3000-level courses from two different disciplines |       | 6       |
| <b>Literature</b>   |       |         |

|   |           |
|---|-----------|
| Select one course from the following fields:  | 3         |
| Classics  |           |
| English   |           |
| Modern Languages and Literatures  |           |
| <b>Natural Sciences</b>   |           |
| Select two natural science courses with lab <sup>2</sup>                              | 8         |
| <b>Visual and Performing Arts</b>   |           |
| Select one 1000-level course from the following fields in Visual and Performing Arts: | 3         |
| Art History and Visual Culture  |           |
| Film, Television, and Media Arts  |           |
| Music   |           |
| Studio Art  |           |
| Theatre   |           |
| <b>Total Credits</b>  | <b>26</b> |

<sup>2</sup> Typical courses that fulfill this requirement may include:

- BIOL 1107 and BIOL 1108 with labs
- CHEM 1171 and CHEM 1172 with labs
- PHYS 1171 and PHYS 1172 with labs

## Plan of Study

A typical four-year full-time plan of study appears below. Some variation may be possible. Students should always discuss their individual plan of study with their advisor prior to registering for courses.

| Course             | Title   | Credits   |
|--------------------|---|-----------|
| <b>First Year</b>  |   |           |
| <b>Fall</b>        |   |           |
| CPSC 1101          | Introduction to Computing (placement based)<br>or ENGR 1031<br>or Fundamentals of Engineering | 3         |
| MATH 1141          | Calculus I for Chemistry, Engineering, and Physics Majors                                     | 4         |
|                    | Modern/Classical Language Orientation Tier <sup>5</sup>                                       | 3         |
|                    | Natural Sciences Exploration Tier <sup>9</sup>  | 4         |
|                    | History Orientation Tier <sup>1</sup>   | 3         |
| <b>Credits</b>     |   | <b>17</b> |
| <b>Spring</b>      |   |           |
| CPSC 1131          | Fundamentals of Programming   | 3         |
| ENGL 1001          | Introduction to Rhetoric and Composition  | 3         |
| MATH 1142          | Calculus II for Chemistry, Engineering, and Physics Majors                                    | 4         |
| PHIL 1101          | Introduction to Philosophy  | 3         |
|                    | Natural Sciences Exploration Tier <sup>9</sup>  | 4         |
| <b>Credits</b>     |   | <b>17</b> |
| <b>Second Year</b> |   |           |
| <b>Fall</b>        |   |           |
| CPSC 2231          | Programming Workshop  | 3         |
| CPSC 2231L         | Programming Workshop Lab  | 1         |
| CPSC 2250L         | Computer Science Sophomore Clinic   | 1         |
| CPSC 2304          | Web Development   | 3         |

|                |   |              |
|----------------|---|--------------|
| MATH 2231      | Discrete Mathematics                            | 3            |
|                | Math Elective                                   | 3-4          |
|                | Religious Studies Orientation Tier <sup>1</sup> | 3            |
| <b>Credits</b> |   | <b>17-18</b> |

### Spring

|                |  |              |
|----------------|--|--------------|
| CPEG 2245      | Digital Design I                         | 3            |
| CPEG 2245L     | Digital Design I Lab                     | 1            |
| CPSC 2232      | Data Structures                          | 3            |
| CPSC 2232L     | Data Structures Lab                      | 1            |
|                | Literature Exploration Tier <sup>7</sup> | 3            |
|                | Math Elective                            | 3-4          |
| <b>Credits</b> |  | <b>14-15</b> |

### Third Year

#### Fall

|                |  |           |
|----------------|--|-----------|
| CPEG 3346      | Computer Systems Architecture  | 3         |
| CPSC 3343      | Design and Analysis of Algorithms  | 3         |
| CPSC 3351L     | Computer Science Junior Clinic I   | 1         |
| SWEG 3301      | Software Engineering Methods   | 3         |
|                | History or Philosophy or Religious Studies Exploration Tier <sup>2</sup> | 3         |
|                | History or Philosophy or Religious Studies Exploration Tier <sup>2</sup> | 3         |
| <b>Credits</b> |  | <b>16</b> |

#### Spring

|                |  |           |
|----------------|--|-----------|
| CPSC 4331      | Operating Systems  | 3         |
| CPSC 3352L     | Computer Science Junior Clinic II                            | 1         |
| CPSC 3354      | Theory of Programming Languages                              | 3         |
| SWEG 3302      | Software Design Methods                                      | 3         |
|                | Behavioral and Social Sciences Exploration Tier <sup>3</sup> | 3         |
|                | Visual and Performing Arts Exploration Tier <sup>6</sup>     | 3         |
| <b>Credits</b> |  | <b>16</b> |

### Fourth Year

#### Fall

|                |  |           |
|----------------|--|-----------|
| CPSC 3333      | Introduction to Cybersecurity                                | 3         |
| ENGR 4961      | Senior Design Project I                                      | 3         |
|                | Behavioral and Social Sciences Exploration Tier <sup>3</sup> | 3         |
|                | Major Elective <sup>4</sup>                                  | 3         |
|                | General Elective <sup>8</sup>                                | 3         |
| <b>Credits</b> |  | <b>15</b> |

#### Spring

|                      |                               |            |
|----------------------|-------------------------------|------------|
| ENGR 4962            | Senior Design Project II      | 3          |
|                      | Major Elective <sup>4</sup>   | 3          |
|                      | Major Elective <sup>4</sup>   | 3          |
|                      | Major Elective <sup>4</sup>   | 3          |
|                      | General Elective <sup>8</sup> | 3          |
| <b>Credits</b>       |                               | <b>15</b>  |
| <b>Total Credits</b> |                               | <b>127</b> |

<sup>1</sup> Choose an appropriate History or Religious Studies course at the 1000 level.

<sup>2</sup> Choose any appropriate Religious Studies, History, or Philosophy core course.

<sup>3</sup> Core Social Science course may be filled by appropriate courses in Communication, Economics, Psychology, Politics, or Sociology and Anthropology.

<sup>4</sup> Students may choose one elective from any of the following courses in this group:

CPSC 4322 Visual Analytics

CPSC 4355 Artificial Intelligence

CPSC 4357 Database Management Systems

CPSC 4360 Machine Learning

CPSC 4521 Information Visualization

Students may choose a second elective from any of the following courses in this group:

CPSC 3349 Cloud Computing

CPSC 4314 Network Security

The remaining two major electives are chosen from the department under advisement of the faculty advisor and department chair.

<sup>5</sup> Choose any language offered by the Department of Modern Languages and Literatures, based on a placement exam.

<sup>6</sup> Visual and Performing Art History courses may be chosen from Art History, Music, Film, Television, and Media Arts, Studio Art, or Theatre.

<sup>7</sup> Approved English, Modern Languages and Literatures, or Classics courses.

<sup>8</sup> General Electives may be chosen from any courses offered at the university, and are frequently chosen to help fulfill requirements toward a chosen minor

<sup>9</sup> Lab science elective is typically met by any lab course in Biology, Chemistry, or Physics.