The Department of Computer Science (CS) offers programs leading to the Bachelor of Science in Computer Science (BSCS), Master of Science with a major in computer science, and Doctor of Philosophy with a major in computer science. A linked undergraduate to graduate option is available that leads to a Bachelor of Science in Computer Science and a Master of Science with a major in computer science. The BSCS courses are offered via traditional live lectures and distance learning options.

At the undergraduate level the Department of Computer Science jointly offers a program with the Department of Electrical and Computer Engineering in the College of Engineering and Technology leading to a Bachelor of Science in Computer Engineering. A linked undergraduate to graduate option is available that leads to Bachelor of Science in Computer Science and Master of Business Administration degrees. The CS department also supports the computer technology concentration of the Engineering Technology bachelor’s degree and the Modeling, Simulation and Visualization Engineering bachelor's degree.

Computer science traces its foundation to mathematics, logic and engineering. Students in this program are exposed to the broad theoretical and practical basis of computer science in lectures and laboratory experiences. Through laboratories, students are introduced to both the experimental and the design aspects of computer science. Students may choose their electives to obtain an emphasis in databases, networking, web programming, systems programming, game programming, and cyber security.

The CS Department's curriculum applies computer science education to the real world. The Professional Workforce Development courses (CS 410 and CS 411W) expand upon the experimental and design approach of earlier courses by addressing the creativity and productivity required for business and industrial applications today. Faculty and industry representatives provide project concepts and mentor student teams in design and development of usable products.

### Bachelor of Science in Computer Science

#### Curriculum Requirement

The Bachelor of Science in Computer Science requires the successful completion of a minimum of 120 semester credit hours of approved course work. At least 30 credit hours overall and 12 credit hours in upper-level courses in the major program must be completed at Old Dominion University. In order to gain appropriate exposure and competency in basic computer science theory and applications, students must satisfy the General Education requirements and the following departmental requirements.

#### Requirements

##### Lower-Division General Education

**Skills**

<table>
<thead>
<tr>
<th>Written Communication *</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 110C &amp; ENGL 231C</td>
<td>English Composition and Introduction to Technical Writing (preferred)</td>
</tr>
</tbody>
</table>

**Mathematical Skills (satisfied in the major)**

<table>
<thead>
<tr>
<th>Oral Communication</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM 101R</td>
<td>Public Speaking (preferred)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information Literacy and Research</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 121G</td>
<td>Introduction to Information Literacy and Research for Scientists (preferred)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Language and Culture (competence must be at the 102 level)</th>
<th>0-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ways of Knowing</td>
<td>3</td>
</tr>
<tr>
<td>Human Creativity</td>
<td></td>
</tr>
</tbody>
</table>

**Human Creativity**

**Human Creativity**

**Lower-Division General Education**

**Literature**

<table>
<thead>
<tr>
<th>The Nature of Science **</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Behavior</td>
<td>3</td>
</tr>
<tr>
<td>Interpreting the Past</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy and Ethics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Impact of Technology (satisfied in the major by CS 300T)**

<table>
<thead>
<tr>
<th>Total Hours</th>
<th>35-41</th>
</tr>
</thead>
</table>

* Grade of C or better required in both courses

** Computer Science majors must complete two Nature of Science courses in sequence from the following:

<table>
<thead>
<tr>
<th>BIOL 121N &amp; BIOL 122N</th>
<th>General Biology I and General Biology I Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 123N &amp; BIOL 124N</td>
<td>General Biology II and General Biology II Lab</td>
</tr>
<tr>
<td>BIOL 136N &amp; BIOL 137N</td>
<td>Honors General Biology I and Honors General Biology I Lab</td>
</tr>
<tr>
<td>BIOL 138N &amp; BIOL 139N</td>
<td>Honors General Biology II and Honors General Biology II Lab</td>
</tr>
<tr>
<td>CHEM 105N &amp; CHEM 106N</td>
<td>Introductory Chemistry and Introductory Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 107N &amp; CHEM 108N</td>
<td>Introductory Organic and Biochemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 121N &amp; CHEM 122N</td>
<td>Foundations of Chemistry I Lecture and Foundations of Chemistry I Laboratory</td>
</tr>
<tr>
<td>CHEM 123N &amp; CHEM 124N</td>
<td>Foundations of Chemistry II Lecture and Foundations of Chemistry II Laboratory</td>
</tr>
<tr>
<td>OEAS 106N &amp; OEAS 108N</td>
<td>Introductory Oceanography and Understanding Global Climate Change</td>
</tr>
<tr>
<td>OEAS 110N</td>
<td>Earth Science</td>
</tr>
<tr>
<td>OEAS 111N</td>
<td>Physical Geology</td>
</tr>
<tr>
<td>OEAS 112N</td>
<td>Historical Geology</td>
</tr>
<tr>
<td>PHYS 101N &amp; PHYS 102N</td>
<td>Conceptual Physics and Conceptual Physics</td>
</tr>
<tr>
<td>PHYS 111N &amp; PHYS 112N</td>
<td>Introductory General Physics and Introductory General Physics</td>
</tr>
<tr>
<td>PHYS 231N &amp; PHYS 232N</td>
<td>University Physics and University Physics</td>
</tr>
</tbody>
</table>

**Upper Division General Education**

- Option A. Approved Disciplinary Minor (a minimum of 12 hours determined by the department), or second degree or second major.
- Option B: Interdisciplinary Minor (specifically 12 hours, 3 of which may be in the major)
- Option C. International Business and Regional Courses or an approved Certification Program such as teaching licensure
- Option D. Two Upper-Division Courses from outside the College of Sciences and not required by the major (6 hours)

In addition to completing the University's lower-division general education requirements and upper-division general education requirements, a computer science major must complete the following courses.

#### Required Computer Science Courses

| CS 150 | Problem Solving and Programming I |
| CS 170 | Introduction to Computer Architecture I |
| CS 250 | Problem Solving and Programming II |
| CS 252 | Introduction to Unix for Programmers |
| CS 270 | Introduction to Computer Architecture II |
| CS 300T | Computers in Society |
### Elective Computer Science Courses

Three additional CS courses (9 credits) at the 300/400 level (excluding CS 333, CS 334 and CS 382).

Computer science majors may select their own electives from the CS offerings or may be guided by the following emphasis areas. Up to six credits of work experience (CS 367 or CS 368) may be used.

#### Database
- **CS 450** Database Concepts 3
- **CS 456** Database Administration I 3
- **CS 457** Database Administration II 3

#### Networking
- **CS 454** Network Management 3
- **CS 455** Introduction to Networks and Communications 3
- **CS 458** Unix System Administration 3
- **CS 472** Network and Systems Security 3
- **CS 486** Introduction to Parallel Computing 3
- **CS 487** Applied Parallel Computing 3

#### Systems Programming
- **CS 476** Systems Programming 3
- **CS 454** Network Management 3
- **CS 488** Principles of Compiler Construction 3

#### Web Programming
- **CS 312** Internet Concepts 3
- **CS 418** Web Programming 3
- **CS 431** Web Server Design 3
- **CS 441** App Development for Smart Devices 3

#### Game Programming
- **CS 480** Introduction to Artificial Intelligence 3
- **CS 460** Computer Graphics 3
- **CS 475** Introduction to Computer Simulation 3

#### Cyber Security
- **CS 462** Cybersecurity Fundamentals 3
- **CS 463** Cryptography for Cybersecurity 3
- **CS 464** Networked Systems Security 3
- **CS 465** Information Assurance 3

#### Miscellaneous
- **CS 451** Software Engineering Survey 3
- **CS 488** Principles of Compiler Construction 3

### Technical Electives

- **MATH 212** Calculus II 4
- **MATH 316** Introductory Linear Algebra 3
- **STAT 330** An Introduction to Probability and Statistics 3

**Technical Electives** * 6-8

**Total Hours** 20-22

* Computer science majors must complete two courses not counted toward another degree requirement. These may be selected from biology, chemistry, ocean, earth and atmospheric sciences, and physics (excluding BIOL 105N-BIOL 106N, BIOL 110N, BIOL 111N, BIOL 112N, BIOL 113N, BIOL 117N, BIOL 118N, and PHYS 103N-PHYS 104N). With the approval of a computer science advisor, other technically oriented courses may be used to meet this requirement.

Computer science majors must earn a grade of C or better in all (non-elective) computer science courses required for the major and in all computer science prerequisite courses. A minimum of 9 credits of upper-level (300/400) computer science elective courses must be completed in addition to the required courses.

Requirements for graduation include a minimum cumulative grade point average of 2.00 overall and in the major, 120 credit hours, which must include both a minimum of 30 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University, passage of the Computer Science Exit Exam, completion of ENGL 110C, ENGL 211C or 221C or 231C, and the writing intensive (W) course in the major with a grade of C or better, and completion of a Senior Assessment. Additional hours may be required to meet the foreign language requirement.

### Honors Program

Students may obtain a Bachelor of Science in Computer Science with an honors designation through the completion of three junior/senior level computer science courses with honors designation and by achieving a 3.50 in-major GPA.

### Advanced Placement

The Department of Computer Science awards credit for CS 133 to students who achieve a score of 3, 4, or 5 on the AP Computer Science A or AB exams or a 5, 6, or 7 on the IB Computer Science exams.

### Cooperative Education

Computer science majors interested in gaining practical experience and on-the-job training while completing undergraduate degree requirements may find opportunities through participation in the Cooperative Education Program.

Those students usually start in the junior year working with an employer in a field of computer science. Students must apply through the Career Management Center prior to registering for Cooperative Education credit. All work experiences must be approved by Career Management and the academic department concerned.

Undergraduates can earn a maximum of six semester credits through cooperative education that apply toward degree requirements. For further information, see the Career Management section of this Catalog.

### Professional Development Tracks

#### Database Administration with Oracle Software

This track was developed in cooperation with Oracle Corporation. It prepares students for roles in modern database environments. Students may achieve Oracle DBA certification upon completion of this track. Key concepts, techniques and skills required for administering a state-of-the-art database platform are developed. The courses in this track include CS 450, CS 456, and CS 457.
Network Design and Administration

This track is intended for students who wish to establish a career in network design and administration in networking computing environments. Students will get hands-on experience in designing networks by configuring routers and switches and work with LAN and WAN routing protocols. This track includes coverage of the information required to take the CISCO, CCNA and CCNP certification. Courses under this track include CS 454 and CS 455.

Computer Science Add-on Endorsement for Professional Education License

A person licensed by the Commonwealth of Virginia to teach in secondary schools may add an endorsement for computer science by completing this program. The required courses are:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 150</td>
<td>Problem Solving and Programming I</td>
<td>4</td>
</tr>
<tr>
<td>CS 170</td>
<td>Introduction to Computer Architecture I</td>
<td>3</td>
</tr>
<tr>
<td>CS 250</td>
<td>Problem Solving and Programming II</td>
<td>4</td>
</tr>
<tr>
<td>CS 252</td>
<td>Introduction to Unix for Programmers</td>
<td>1</td>
</tr>
<tr>
<td>CS 312</td>
<td>Internet Concepts</td>
<td>3</td>
</tr>
<tr>
<td>CS 330</td>
<td>Object-Oriented Programming and Design</td>
<td>3</td>
</tr>
<tr>
<td>or CS 355</td>
<td>Principles of Programming Languages</td>
<td></td>
</tr>
<tr>
<td>CS 361</td>
<td>Advanced Data Structures and Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CS 381</td>
<td>Introduction to Discrete Structures</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours: 24

For more information, refer to the Darden College of Education section of this Catalog.

Bachelor of Science in Computer Engineering

The computer engineering undergraduate degree program is designed to provide both a broad engineering background and comprehensive foundation in the technical principles underlying the computer area. Students develop a background through course work in mathematics, the basic sciences, and general engineering. The technical core consists of courses from electrical and computer engineering to address hardware aspects of computer engineering and course work from computer science to address software aspects. A grade of C or better must be earned in computer science required courses. In addition, course work in General Education perspectives and communication skills is required to assure a well rounded program of study. Specific degree requirements can be found listed under the Department of Electrical and Computer Engineering.

Due to limited laboratory facilities, admission to the computer engineering program is on a competitive basis. Students should apply to the Department of Electrical and Computer Engineering.

Bachelor of Science in Engineering Technology with a Concentration in Computer Engineering Technology

The goal of the computer engineering technology program is to prepare students for employment in areas defined by the rapidly expanding opportunities of computer applications. With new hardware and software products being introduced monthly, students who wish to succeed in this field should develop a background in both software and hardware. This program provides such a background by combining a grounding in basic theory with hands-on, application courses selected from the disciplines of Computer Science and Electrical Engineering Technology. The curriculum emphasizes practical design and the utilization of systems and hardware. Areas of concentration include network design and management, modern communication systems, microcomputer systems and applications, and application program development. A grade of C or better must be earned in computer science required courses. Specific degree requirements can be found listed under the Department of Engineering Technology.

Minor in Computer Science

Students may minor in computer science by taking the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 150</td>
<td>Problem Solving and Programming I</td>
<td>4</td>
</tr>
<tr>
<td>CS 250</td>
<td>Problem Solving and Programming II</td>
<td>4</td>
</tr>
<tr>
<td>CS 252</td>
<td>Introduction to Unix for Programmers</td>
<td>1</td>
</tr>
<tr>
<td>CS 361</td>
<td>Advanced Data Structures and Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>or CS 330</td>
<td>Object-Oriented Programming and Design</td>
<td>3</td>
</tr>
</tbody>
</table>

Select two CS Electives at the 400-level or from the following: 6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 312</td>
<td>Internet Concepts</td>
<td></td>
</tr>
<tr>
<td>CS 330</td>
<td>Object-Oriented Programming and Design</td>
<td></td>
</tr>
<tr>
<td>CS 355</td>
<td>Principles of Programming Languages</td>
<td></td>
</tr>
<tr>
<td>CS 361</td>
<td>Advanced Data Structures and Algorithms</td>
<td></td>
</tr>
<tr>
<td>CS 350</td>
<td>Introduction to Software Engineering</td>
<td></td>
</tr>
<tr>
<td>CS 381</td>
<td>Introduction to Discrete Structures</td>
<td></td>
</tr>
<tr>
<td>CS 390</td>
<td>Introduction to Theoretical Computer Science</td>
<td></td>
</tr>
</tbody>
</table>

Total Hours: 18

A grade of C or better is required in each course. Students must also meet the University's requirements for a minor as described under Requirements for Undergraduate Degrees.

The curriculum for the Bachelor of Science in Engineering Technology with an emphasis in computer engineering technology and the Bachelor of Science in Computer Engineering contain a built-in minor in computer science.

Minor in Web Programming

Students may minor in Web Programming by taking the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 330</td>
<td>Object-Oriented Programming and Design</td>
<td>3</td>
</tr>
<tr>
<td>CS 418</td>
<td>Web Programming</td>
<td>3</td>
</tr>
</tbody>
</table>

Select two of the following: 6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 312</td>
<td>Internet Concepts</td>
<td></td>
</tr>
<tr>
<td>CS 431</td>
<td>Web Server Design</td>
<td></td>
</tr>
<tr>
<td>CS 432</td>
<td>Web Science</td>
<td></td>
</tr>
<tr>
<td>CS 441</td>
<td>App Development for Smart Devices</td>
<td></td>
</tr>
<tr>
<td>CS 462</td>
<td>Cybersecurity Fundamentals</td>
<td></td>
</tr>
<tr>
<td>CS 465</td>
<td>Information Assurance</td>
<td></td>
</tr>
</tbody>
</table>

Total Hours: 12

* CS 252 and CS 333 are prerequisites and are not included in the calculation of the grade point average for the minor.

A grade of C or better is required in any of these courses if they are used as a prerequisite to any other CS course. Students must also meet the University's requirements for a minor as described under Requirements for Undergraduate Degrees.

Linked Bachelor of Science in Computer Science and Master of Business Administration

This program allows students to earn a Bachelor of Science in Computer Science and a Master of Business Administration. After students have satisfactorily completed their undergraduate requirements, they must complete the remaining requirements in the MBA program. Additional information can be found in the section on B.S./M.B.A. Linked Program listed at the beginning of the College of Sciences section of this Catalog. Students interested in this program should contact the MBA Program as early as possible. The MBA Program manager will act as an advisor to the student in addition to the Computer Science advisor.

Old Dominion University 3
Linked Bachelor of Science in Computer Science and Master of Science in Computer Science

This program allows exceptionally successful students to earn both a bachelor's and master's degree in computer science. Up to 12 credits of graduate coursework may be counted toward both their undergraduate and master's degrees in computer science. Students must earn a minimum of 150 credit hours (120 for the undergraduate degree and 30 for the graduate degree).

Admission

To be admitted to the linked program, students must have completed at least 60 undergraduate credit hours with at least 24 credit hours from ODU. Students must have completed CS 361, CS 381, MATH 212 and all prerequisites for those courses. At the time of admission, they must have an overall GPA of 3.00 or better, and an overall GPA of 3.00 or better in CS and MATH courses.

Interested students who meet the admission requirements should apply to the graduate program director, after consulting with the undergraduate chief departmental advisor, as soon as possible upon completing the required courses and 60 credit hours. In consultation with the graduate program director, a student will:

1. Officially declare an undergraduate Computer Science major with the
   undergraduate chief departmental advisor.
2. Draft a schedule of graduate courses to be taken as an undergraduate to
   be presented to the undergraduate chief departmental advisor.
3. Apply, during their senior year, to the Office of Graduate Admissions
   for admission to the master's in computer science program.

Students who have completed at least six hours of graduate courses upon
attaining senior standing (completion of 90 credit hours) and who have
earned a GPA of 3.00 or better in those courses will not be required to take
the Graduate Record Exam (GRE) for admission to the master's program.
Otherwise, in keeping with normal admission requirements for the M.S. in
computer science, students will take the GRE as an undergraduate and will
subsequently be reevaluated for continuation into the master's program.

Once students have been awarded their bachelor's degree and fulfilled all
regular admission requirements for the M.S. in computer science, they will
be officially admitted into the M.S. program.

Program Requirements

Students in the program will fulfill all normal admission and curricular
requirements for both a Bachelor of Science in Computer Science and an
M.S. in computer science with the following exceptions:

1. Students in the program may count up to 12 hours of graduate courses,
at the 500 or 600 level, excluding independent study, taken as an
   undergraduate toward both the bachelor's and master's degrees in
   computer science.
   a. Students in the program may substitute computer science graduate
courses for undergraduate courses according to the following
schema. All students must complete an undergraduate writing
intensive course in the major.

   Students may substitute 500- and 600-level courses for the upper-
   level CS electives in the undergraduate program so long as they
   have the prerequisites for those courses. 700- or 800-level courses
   may not be used.
   b. Students will not receive credit for both the 400 and 500 level
   version of the same course.
   c. Students in the program may make a written petition for other
   substitutions to the graduate program director, who will consider
   them in consultation with the chief departmental advisor and the
   instructor(s) of the courses involved.

NOTES:

1. In accordance with University policy, up to 21 hours of graduate courses
taken as an undergraduate may be counted toward the bachelor's degree
in computer science. However, only 12 hours of graduate courses
taken as an undergraduate may also be counted toward the M.S. degree
in computer science. This will limit students' scheduling flexibility
subsequently.
2. Like students in the regular M.S. in computer science program, students
in the linked B.S.C.S./M.S. computer science degree may count no
more than 12 hours at the 500-level toward their M.S. degree. Students
are advised against taking all 12 of those 500-level credits as an
undergraduate, since doing so will limit their scheduling flexibility
subsequently.

Computing Facilities

The Computer Science Department at Old Dominion University offers a
wide array of facilities, resources, and services to our faculty, staff, students
and guests. Assets are distributed between Dragas Hall and the Engineering
and Computational Sciences Building (E&CS). This system architecture
enables our services to be configured in a redundant/highly-available
manner. This stability and resiliency is essential to maintaining a high level
of service to over 2,300 users.

The E&CS building is home to our primary data-center and main
administrative office. It also houses several of our research labs, a
multimedia conference room, and our network operations center. Dragas
Hall contains several instructional and research labs, our satellite
administrative office, secondary conference room, redundant data-center,
extended network operations center, and support staff offices.

The department offers a heterogeneous computing environment that
primarily consists of Windows and *nix based workstations and servers.
On the Windows domain, users are offered network logons, Exchange
email, terminal services via our Virtual Computing Lab (VCLab) where
users can have access to our software remotely, roaming profiles, MSSQL
database access for research, and Hyper-V virtualization for research/faculty
projects. For Unix and Linux users we support Solaris, Ubuntu and Red Hat
Enterprise Linux (RHEL) distributions. Our *nix services include DNS,
NIS, Unix mail, access to personal MySQL databases, class and research
project Oracle databases, and both Linux and Unix servers for secure shell
sessions.

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project Oracle databases, and both Linux and Unix servers for secure shell
sessions.