Department of Computer Science

Web Site: http://www.cs.odu.edu

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Desh Ranjan, Chair
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Programs

The Department of Computer Science offers programs leading to the Master of Science with a major in computer science, a linked five year combined B.S.C.S. and M.S. with a major in computer science and the Doctor of Philosophy in computer science. The Department of Computer Science also offers a Master of Science in computer science with a computer information sciences emphasis (jointly with the Information Technology Department in the Strome College of Business).

Computer science traces its foundation to mathematics, logic and engineering. Studies in computer science encompass theory, experimental techniques, and engineering methodology. The computer science curriculum exposes students to aspects of each of these disciplines and fosters an appreciation and understanding of them. Students are exposed to the broad theoretical basis of computer science through lecture and laboratory experience. The Computer Science Department has a unique curricular model that applies computer science education to the real world. In addition, the Computer Science Department offers a set of courses to professionals who need supplementary experience. A graduate of the computer science program will have a broad fundamental knowledge of the field and in-depth knowledge in a particular subject area. To acquire breadth, graduate students in the department are required to take core courses which together with the undergraduate core courses cover major aspects of computers and computation. At the master’s level, the department supports in-depth study in the following areas:

- bioinformatics,
- data mining,
- digital libraries,
- high performance computing,
- networking,
- cybersecurity,
- software engineering, and
- computational foundations.

At the Ph.D. level, areas of specialization are limited only by the interests of the available faculty. The department has an excellent state of the art computing facility. Please visit the department’s home page for details: http://www.cs.odu.edu.

Master of Science - Computer Science

Entrance Requirements

Students entering the Master of Science program in computer science should meet the minimum university graduate admission requirements (http://www.odu.edu/admission/graduate). In addition, an applicant must have a strong background in computer science. Students who do not have a sufficient background in computer science may enter the graduate program as provisional students and make up for their deficiencies by taking appropriate courses. Applicants are required to take the GRE general test. For the Computer Information Sciences emphasis area (described below), the GMAT aptitude test may be used. Two letters of recommendation from faculty members of academic institutions are required in addition to all transcripts at the postsecondary level. For students whose native language is not English, either a TOEFL score of 550 (paper-based) and 79 (internet-based) or IELTS score of 6.5 is also required.

Requirements

The departmental requirements for the master’s degree are described below. All these requirements must be satisfied in addition to the University requirements outlined under the Academic Information section of this Catalog.

Core courses

As approved by the GPD from a list of courses such as:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 550</td>
<td>Database Concepts</td>
<td>3</td>
</tr>
<tr>
<td>CS 555</td>
<td>Introduction to Networks and Communications</td>
<td>3</td>
</tr>
<tr>
<td>CS 517</td>
<td>Computational Methods and Software</td>
<td>3</td>
</tr>
<tr>
<td>CS 600</td>
<td>Algorithms and Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>CS 665</td>
<td>Computer Architecture</td>
<td>3</td>
</tr>
</tbody>
</table>

Colloquium

Each student is required to take a one-credit CS 690 (Computer Science Colloquium) and attend at least 10 departmental colloquiums during their MS study.

Course options

Three options are available for candidates for master’s degrees:

- thesis option,
- project option, and
- course-only option.

Thesis Option

| Course work | 24 |
| Thesis research | 6 |
| Colloquium | 1 |
| **Total Hours** | **31** |

A minimum of 31 credit hours is required. The candidate is required to write a thesis and make an oral presentation of the results.

Project Option

| Course work | 30 |
| Project work | 3 |
| Colloquium | 1 |
| **Total Hours** | **34** |

A minimum of 34 credit hours is required. The candidate is required to prepare a written report on the project and to present it orally.

Course-only Option

| Course work | 33 |
| Colloquium | 1 |
| **Total Hours** | **34** |

A minimum of 34 credit hours is required. In addition, the candidate is required to appear for an exit examination that requires a comprehensive written report and an oral examination.

Course restrictions

No more than six credits of the following courses may be counted towards the degree:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 697</td>
<td>Independent Study in Computer Science</td>
</tr>
<tr>
<td>CS 791</td>
<td>Graduate Seminar</td>
</tr>
<tr>
<td>CS 796</td>
<td>Topics in Computer Science</td>
</tr>
</tbody>
</table>

**Total Hours** 0

A maximum of four 500-level courses can be applied to the program.
At least three credits counted toward the computer science degree must be taken at the 700-level from courses other than CS 791 and CS 796.

**Time Limit**
All requirements for the master’s degree must be completed within six years.

**Master of Science - Computer Information Systems Emphasis**

**Requirements**
This area, offered jointly with the Information Systems and Technology Department of the Strome College of Business, is appropriate for students with either a bachelor’s degree in business administration with a major in information systems and a computer science minor or with a bachelor’s degree in computer science with a business administration minor.

**Colloquium**
Each student is required to take one-credit CS 690 (Computer Science Colloquium) and attend at least 10 departmental colloquiums during their MS study.

**Course options**
Same as described above in the M.S. in computer science, with the following conditions:

- Project option: 15 credits (5 courses) must be CS graduate courses, and 15 credits (5 courses) must be IT graduate courses.
- Course-only option: 18 credits (6 courses) must be CS graduate courses, and 15 credits (5 courses) must be IT graduate courses.

**Course restrictions**
Same as described above in the M.S. in computer science.

In addition, at least two of the CS graduate courses (6 credits) must be taken at the 600-level or 700-level from courses other than CS 697, CS 791, and CS 796.

**Time Limit**
All requirements for the master’s degree must be completed within six years.

**Linked B.S. and M.S. in Computer Science**
This program allows for exceptionally successful students to earn both a B.S. and M.S. in Computer Science by allowing them to count up to 12 credits of graduate coursework toward both their bachelor’s and master’s degree in Computer Science. All options available under the MS program are available under this program.

**Graduate Certificate Program in Cyber Security (On-line)**
This on-line certificate program, which may be completed in one year, is designed to train working professionals (in computer science and related fields) in cyber security. The courses offered under this program may be taken by current students or new students. A student must first apply to the certificate program and be admitted to the program to be eligible to receive the certificate. A student admitted to this program may subsequently apply for MS in CS. If admitted, the courses taken during the certificate program may be considered towards the MS program.

Candidates for the program must at least have a 4-year Bachelor’s degree from an accredited academic institution. The program requires a student to take four (or 12 credits) of the following courses. Each course has a normal letter grade and a student is expected to obtain a C or better in each course and maintain a 3.0 GPA. Following are the current offerings. Additional electives may be added in future.

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 562</td>
<td>Cybersecurity Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>CS 563</td>
<td>Cryptography for Cybersecurity</td>
<td>3</td>
</tr>
<tr>
<td>CS 564</td>
<td>Networked Systems Security</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Hours**
12

**Graduate Modeling and Simulation Certificate in Computing and Informatics**

This certificate program has a focus on computational science and informatics disciplines. The required coursework includes introductory topics in fundamental theories and approaches in computer modeling and simulation. The elective courses enable students to develop deeper understanding in computer modeling and simulation and/or to make use of their knowledge to disciplines where modeling and simulation play a critical role.

Candidates for the program must have a 4-year Bachelor’s degree from an accredited academic institution. The program requires a student to take four of the following courses. The student is required to take the core course, at most two foundation elective courses, and at least one advanced elective course. Each course has a normal letter grade. The student is expected to obtain a C or better in each course and maintain a 3.0 GPA.

**Core Course**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSIM 601</td>
<td>Introduction to Modeling and Simulation</td>
<td>3</td>
</tr>
</tbody>
</table>

**Foundation Elective Courses (select up to 2 from the following):**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 712</td>
<td>Stochastic Modeling</td>
<td></td>
</tr>
<tr>
<td>CS 713</td>
<td>Modeling and Simulation in Computational Biology</td>
<td></td>
</tr>
<tr>
<td>CS 714</td>
<td>Monte Carlo Simulation</td>
<td></td>
</tr>
<tr>
<td>CS 715</td>
<td>Medical Image Computing and Simulation</td>
<td></td>
</tr>
<tr>
<td>CS 716</td>
<td>Communication Networks Simulation and Evaluation</td>
<td></td>
</tr>
<tr>
<td>CS 722</td>
<td>Machine Learning</td>
<td></td>
</tr>
<tr>
<td>CS 723</td>
<td>Introduction to Bioinformatics</td>
<td></td>
</tr>
</tbody>
</table>

**Advanced Elective Courses (select at least 1 of the following at 700/800 level):**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 712</td>
<td>Stochastic Modeling</td>
<td></td>
</tr>
<tr>
<td>CS 713</td>
<td>Modeling and Simulation in Computational Biology</td>
<td></td>
</tr>
<tr>
<td>CS 714</td>
<td>Monte Carlo Simulation</td>
<td></td>
</tr>
<tr>
<td>CS 715</td>
<td>Medical Image Computing and Simulation</td>
<td></td>
</tr>
<tr>
<td>CS 716</td>
<td>Communication Networks Simulation and Evaluation</td>
<td></td>
</tr>
<tr>
<td>CS 722</td>
<td>Machine Learning</td>
<td></td>
</tr>
<tr>
<td>CS 723</td>
<td>Introduction to Bioinformatics</td>
<td></td>
</tr>
<tr>
<td>CS 724</td>
<td>High Performance Computing and Big Data</td>
<td></td>
</tr>
<tr>
<td>CS 725</td>
<td>Information Visualization</td>
<td></td>
</tr>
<tr>
<td>CS 726</td>
<td>Application of Graphs in Bioinformatics</td>
<td></td>
</tr>
</tbody>
</table>

**Total Hours**
12

**Doctor of Philosophy - Computer Science**

**Admission**

Students entering the Ph.D. program in the Computer Science Department should meet the minimum university graduate admission requirements (http://www.odu.edu/admission/graduate). Students may be admitted directly to the Ph.D. program with either a bachelor's or a master's degree. Prior to applying for admission, students are encouraged to visit the department's website and ensure that their research interests match with that of a faculty member. Students are expected to show proficiency in Problem Solving and Programming, Introduction to Computer Architecture, Advanced Data Structures and Algorithms, Introduction to Theoretical Computer Science, and Operating Systems at an undergraduate level. Those entering the Ph.D. program with deficiencies in these areas will have to make them up.
Requirements
A candidate for the doctoral degree in computer science must meet all of the following requirements in addition to the university requirements outlined under the Academic Information section in this Catalog:

1. Pass the Ph.D. qualifying process that consists of breadth oral examination, research ability oral examination, and advanced course requirement.
2. Complete a minimum of 72 credit hours beyond the bachelor’s degree and 48 credit hours beyond the master’s degree.
3. Pass the candidacy examination.
4. Attend at least 10 colloquia as detailed below.
5. Successfully defend the dissertation.

The above must be completed within eight years after admission to the Ph.D. program. Note that students with a degree in a discipline outside of computer science will be required to take prerequisite undergraduate courses that will not be counted towards the 72 credit hours requirement.

Advisor
Upon admission to the Ph.D. program, a faculty advisor will be assigned to the student for general guidance. The student, however, is expected to find a dissertation advisor by the time he or she completes the qualifying process.

Course Requirements
Students with a master's degree in computer science must complete coursework as specified below:

1. A minimum of 24 hours of post-master’s coursework at 800-level.
2. Complete the dissertation work of 24 credit hours or more.
3. A maximum of six hours may be transferred into the Ph.D. program from post-master’s coursework done elsewhere.

Students with an undergraduate degree in computer science must complete coursework as specified below:

1. 12 credit hours of core coursework approved by the GPD from a list of courses such as: CS 550, CS 555, CS 517, CS 600, and CS 665.
2. A minimum of 36 hours of coursework at 600-level or above, of which at least 24 credit hours must be at 800-level.
3. Complete the dissertation work of 24 credit hours or more.

Students with an undergraduate degree in a discipline outside computer science must complete the 72 credit hours of coursework as specified above. Additionally, these students need to demonstrate proficiency in Problem Solving & Programming, Introduction to Computer Architecture, Advanced Data Structures and Algorithms, Introduction to Theoretical Computer Science and Operating Systems at an undergraduate level.

Research Guidance Committee
A Research Guidance Committee will be formed after the student has passed the breadth oral examination of the PhD qualifying process. The duties of a Research Guidance Committee are:

1. To advise the student on the course preparation, in particular to help prepare a plan of study.
2. To help define the research area of the student.
3. To prepare and administer the candidacy exam.

A Research Guidance Committee is formed according to the following procedure:

1. The student finds a regular faculty advisor. Note that a regular faculty advisor can be different from the temporary faculty advisor assigned to the student upon admission to the Ph.D. program.
2. The advisor selects the members of the Research Guidance Committee in cooperation with the student and the Graduate Studies Committee.
3. The Research Guidance Committee consists of at least three ODU faculty members. At least two of these must be from the Computer Science Department and one may be from outside of the Computer Science Department. All committee members must be certified for graduate instruction. The current research interests of the computer science members of the committee should be related to the research goals of the student.
4. Additional members may be appointed to the committee.
5. The committee must complete a Ph.D. Guidance Committee Form. This form is submitted to the Graduate Program Director by the Graduate Studies Committee and to the Dean of the College of Sciences for approval.

Candidacy Examination
Upon completing coursework, before becoming heavily involved in dissertation work, and no later than three years after acceptance into the Ph.D. program (preferably during the first 18 months after admission into the program), the student must pass a candidacy examination. This examination is designed to test the student’s knowledge of background material related to the dissertation topic and to determine if the student has identified a significant problem, has a plan of attack, and is ready to proceed with the dissertation research.

At least one week before the scheduled examination time (and preferably two weeks before), the student must provide the examination committee with a dissertation research proposal. The proposal should contain the following items (not necessarily in this order):

- a comprehensive literature review on the dissertation topic that should in particular discuss limitations of current approaches and open problems in the topic area
- a description of the research problem
- a discussion of how the problem relates to other work in the field
- a detailed research plan, including proposed tasks and a timeline for completion
- a list of expected contributions.

During the examination, the student will give a 45-minute presentation of the dissertation proposal to be followed by questions from the committee. The exam is expected to last no more than 2 hours.

The presentations of the dissertation proposal is open to the public and will be publicized by the GPD at least one week in advance of the exam. Once the presentation has concluded and the audience has asked general questions, the audience will be excused. The examination by the committee will be held in private, but graduate faculty members are welcome to observe the exam.

Dissertation Committee
After the candidacy exam has been passed and dissertation topic approved, the Research Guidance Committee's responsibilities are completed. A new committee, the Dissertation Committee, is formed to supervise the dissertation research.

A Dissertation Committee is formed according to the following procedure:

1. The faculty advisor selects the members of the Dissertation Committee in cooperation with the student and the Graduate Studies Committee.
2. The Dissertation Committee consists of at least three ODU faculty members. At least two of these must be from the Computer Science Department and one must be from outside of the Computer Science Department. All committee members must be certified for graduate instruction. The current research interests of the computer science members of the committee should be related to the research goals of the student.
3. Additional members may be appointed to the committee. Adjuncts (approved for graduate instruction) and non-university members may be added with approval of the GPD.
4. The committee must complete a Ph.D. Dissertation Committee Form. This form is submitted to the Graduate Program Director by the Graduate Studies Committee and to the Dean of the College of Sciences for approval.
5. The Associate Vice President for Graduate Studies is an ex-officio member of all Dissertation Committees.
Dissertation
A minimum of 24 credit hours of dissertation work is required. The work must represent an achievement in research and must be a significant contribution in the field. Students are required to publish (or have in the revision process) at least one paper in a refereed journal or refereed conference proceedings based on their dissertation work.

Dissertation Defense
The examination will be oral and the examination committee must have the completed dissertation at least two weeks before the examination date. In addition to the examination, students are required to give a public oral presentation on their dissertation results.

Time Requirement
Ph.D. students should normally be full-time. A full-time student can be expected to satisfy all the Ph.D. requirements in three to four years when entering with an M.S. degree or four to five years with a bachelor’s degree. No student (full-time or part-time) will be allowed to study for the Ph.D. degree beyond eight years from the date of admission into the program.

Colloquium
Students are expected to actively participate in the colloquium activities of their research area for at least four semesters.

Ph.D. Qualifying Process
Students who have been admitted to study toward the doctoral degree in computer science must complete the qualifying process which may take up to 18 months after a student has been admitted in the Ph.D. program. The Ph.D. qualifying process consists of three components.

1. Breadth Oral Examination
2. Research Ability Oral Examination
3. Advanced Course Requirement

Breadth Oral Examination
The examination should be passed no later than 12 months after admission into the Ph.D. program (preferably during the first 6 months after admission into the program). In case a student fails the examination, it is still expected that the student will pass the examination within 12 months of admission. The examination may be repeated at most once.

The scheduling of this examination will be on-demand. A student wanting to take the breadth examination will contact the GPD at least six weeks before the suggested date of the examination. Once a student has requested an examination, a committee of four faculty members will be formed that will be responsible for evaluating the student.

The examination will last for two hours. On the day of the examination, the student will be given an initial list of questions two hours before the oral examination. Note that this list will not contain follow-on questions, which the committee is free to ask. Students will be evaluated on their familiarity with core computer science topics. We have organized these topics under the undergraduate computer science course categories. The list of courses is given below. For the most recent syllabi for these courses, please visit: http://www.cs.odu.edu.

- Problem Solving & Programming (CS 250)
- Introduction to Computer Architecture (CS 270)
- Advanced Data Structures and Algorithms (CS 361)
- Introduction to Theoretical Computer Science (CS 390)
- Operating Systems (CS 471)

Research Ability Oral Examination
The examination should be passed no later than 18 months after admission into the Ph.D. program (preferably during the first 12 months after admission into the program). In case a student fails the examination, it is still expected that the student will pass the examination within 18 months of admission. The examination may be repeated at most once.

The scheduling of this examination will be on-demand. A student wanting to take the research ability examination will select one of the department approved areas and contact the GPD at least six weeks before the desired date of the examination. Once a student has requested an examination, the selected area committee members will be responsible for evaluating the student.

A student who has completed a master's thesis and/or has publications accepted in refereed conferences/journals can apply to the GPD for exemption from the research ability examination. The exemption also requires an endorsement form an ODU CS faculty member who is willing to be the student's Ph.D. advisor. Please contact the GPD for details.

The examination will last two hours. On the day of the examination, the student will be given an initial list of questions two hours before the oral examination. Not that this list will not contain follow-on questions, which the committee is free to ask. Students will be evaluated on their understanding of the reading list (list of papers, book chapters, etc.) maintained by each area committee.

Advanced-level Course Requirement
Ph.D. students are expected to take at least four 800-level regular courses. These four courses should be taught by at least three different faculty members. Ph.D. students are expected to maintain a minimum grade of B in each of these courses. If you have any doubt whether a course is a regular 800-level course and will be counted toward this requirement, please check with your GPD. This requirement should be completed no later than 18 months after admission into the program. Note that these courses will be counted toward the minimum 800-level credit hour requirement for Ph.D. students.