Software Engineering

Department Information

- **Department Head:**
  Kendall E. Nygard, Ph.D.
- **Graduate Coordinator:**
  Gursimran Walia, Ph.D.
- **Department Location:**
  258 QBB
- **Department Phone:**
  (701) 231-8562
- **Department Email:**
  gradinfo@cs.ndsu.edu
- **Department Web Site:**
  cs.ndsu.edu/
- **Application Deadline:**
  February 1 for fall admission; September 1 for spring admission* No summer admission for any Software Engineering Program
- **Credential Offered:**
  Ph.D., M.S., M.S.E, Certificate
- **Test Requirement:**
  GRE (M.S. and Ph.D. only)
- **English Proficiency Requirements:**
  TOEFL iBT 79; IELTS 6.5

*Spring admissions are given only occasionally, depending on funding and faculty interest. If there are no spring openings, spring applicants are automatically considered for the subsequent fall semester.

Program Description

Software Engineering is focused on the application of systematic, disciplined, and quantifiable approaches to the development, operation, and maintenance of software systems. Inclusive of computer programming but going well beyond, Software Engineering is concerned with methodologies, techniques, and tools to manage the entire software life cycle, including development of requirements, specifications, design, testing, maintenance, and project management. The advent of Software Engineering is a natural result of the continuous quest for software quality and reusability, and the maturing of the software development industry.

The Department of Computer Science offers a Graduate Certificate in Software Engineering, Master of Software Engineering, Master of Science in Software Engineering, and Ph.D. in Software Engineering. The programs are designed to appeal to both full-time students and software professionals who are employed and wish to pursue a program part time. The Master of Software Engineering is a course work only program while the Master of Science in Software Engineering is a course work, comprehensive examination and research program. For additional information, see cs.ndsu.edu or contact the Computer Science Department at (701) 231-8562 or gradinfo@cs.ndsu.edu.

In addition to the Graduate School requirements (http://bulletin.ndsu.edu/graduate/admission-information), applicants must fulfill the program requirements listed below:

**Certificate**

1. B.S. or equivalent degree from an educational institution of recognized standing, including 12 semester hours or equivalent of Computer Science or Software Engineering courses from an educational institution of recognized standing, or at least one year full-time professional software engineering experience;
2. Programming skill in a modern higher level programming language, preferably C++, C#, or Java;
3. A 2.85 (on a 4.0 scale) GPA in previous course work.

**Master of Software Engineering**

1. Bachelor's level (B.S., B.A., Sc.B., etc.) degree from an educational institution of recognized standing;
2. Ability to design and implement a program consisting of several interacting classes that might total approximately 100 executable statements;
3. International Students require a minimum TOEFL iBT of 79 or an IELTS of 6.5.
4. A 3.0 (on a 4.0 scale) GPA in previous coursework. Conditional admission may be given with a 2.7 or higher GPA and professional experience.
2 

**Master of Science**

1. Four year or longer B.S. or equivalent degree from an educational institution of recognized standing with at least a 3.0 grade point average on a 4.0 grade point scale. Eighteen semester hours or equivalent in Computer Science from an educational institution of recognized standing, or at least 2 years of full-time professional software engineering experience. Full time professional experience may offset the GPA requirement at the rate of 0.1 in GPA for each 18 months of such experience to a maximum of 0.3 in GPA;

2. Programming skill with one modern higher level programming language, preferably C++, C#, or Java.

3. A 3.0 (on a 4.0 scale) GPA in all previous coursework.

**Doctor of Philosophy**

1. Four year or longer B.S. or equivalent degree from an educational institution of recognized standing with at least a 3.25 grade point average (GPA) on a 4.0 grade point scale. Eighteen semester hours or equivalent in Computer Science from an educational institution of recognized standing, or at least 3 years of full-time professional software engineering experience. Significant full-time professional software development experience may offset this GPA requirement at the rate of 0.1 in GPA for each 2 years of such experience to a maximum of 0.4 in GPA. If the applicant has an M.S. or equivalent degree from an educational institution of recognized standing, the GPA in that degree should be at least 3.35 on a 4.0 scale.

2. Programming skill in at least 1 higher level programming language, preferably C++, C#, or Java.

**Graduate Certificate**

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CSCI 713</td>
<td>Software Development Processes</td>
<td>3</td>
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Select two of the following:

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>CSCI 714</td>
<td>Software Project Planning and Estimation</td>
<td></td>
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<tr>
<td>CSCI 715</td>
<td>Software Requirements Definition and Analysis</td>
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<td>Software Design</td>
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<tr>
<td>CSCI 717</td>
<td>Software Construction</td>
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<tr>
<td>CSCI 718</td>
<td>Software Testing and Debugging</td>
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<tr>
<td>CSCI 848</td>
<td>Empirical Methods in Software Engineering</td>
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**Total Credits**

12

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**Masters of Software Engineering**

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**Core Courses - 15 Credits**

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**Electives - 15 Credits**

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<tr>
<td>CSCI 724</td>
<td>Survey of Artificial Intelligence</td>
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<tr>
<td>CSCI 736</td>
<td>Advanced Intelligent Systems</td>
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<tr>
<td>CSCI 765</td>
<td>Introduction To Database Systems</td>
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<tr>
<td>CSCI 834</td>
<td>Knowledge Based Systems</td>
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<tr>
<td>CSCI 846</td>
<td>Development of Distributed Systems</td>
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<tr>
<td>CSCI 847</td>
<td>Software Complexity Metrics</td>
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**Total Credits - 30**
Master of Science

**Core Courses**

- **CSCI 713** Software Development Processes
- **CSCI 715** Software Requirements Definition and Analysis
  or **CSCI 718** Software Testing and Debugging
- **CSCI 716** Software Design
- **CSCI 765** Introduction To Database Systems

**Six credits (not part of the core) from:**

- **CSCI 714** Software Project Planning and Estimation
- **CSCI 715** Software Requirements Definition and Analysis
- **CSCI 717** Software Construction
- **CSCI 718** Software Testing and Debugging
- **CSCI 845** Formal Methods for Software Development
- **CSCI 846** Development of Distributed Systems
- **CSCI 847** Software Complexity Metrics
- **CSCI 848** Empirical Methods in Software Engineering

Other Computer Science or Computer Engineering courses selected with and approved by the student’s graduate advisory committee. (six - thesis students) or three (paper students)

- **CSCI 790** Graduate Seminar (in software engineering areas (1 credit each), approved by adviser)

**Research Component***

- **CSCI 797** or **CSCI 798**

**Total Credits**

33

Students seeking an option in cybersecurity must take 9 credits from the below list. No more than 3 credits can be from CSCI 790.

**Code**

- **CSCI 676** Computer Crime & Forensics
- **CSCI 793** (cybersecurity focus)
- **CSCI 791** Temporary/Trial Topics (cybersecurity focus)
- **CSCI 790** Graduate Seminar (cybersecurity focus)
- **CSCI 669** Network Security
- **CSCI 773** Foundations of the Digital Enterprise
- **CSCI 783** Topics In Software Systems (cybersecurity focus)

* Either a thesis option or comprehensive study paper based on a significant software development project undertaken by the student, perhaps as a member of a team, either at the University or as part of a job. This project will require design, implementation, and testing of a significant piece of computer software.

Doctor of Philosophy

**Code**

Select 5 from the courses listed below and not duplicating any items used to satisfy requirements for the Master of Science degree: 15

- **CSCI 713** Software Development Processes
- **CSCI 714** Software Project Planning and Estimation
- **CSCI 715** Software Requirements Definition and Analysis
- **CSCI 716** Software Design
- **CSCI 717** Software Construction
- **CSCI 718** Software Testing and Debugging
Courses in Computer Science or Electrical and Computer Engineering approved by the student’s Supervisory Committee.

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<td>Temporary/Trial Topics (cybersecurity focus)</td>
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Total Credits: 39

Students seeking an option in cybersecurity must take 9 credits from the below list. No more than 3 credits can be from CSCI 790.

### Department Faculty

**Anne Denton, Ph.D.**
University of Mainz, 1996
Research Interests: Data Mining, Bioinformatics, Scientific Informatics, Databases, Geospatial Data, Cloud Computing

**Jun Kong, Ph.D.**
University of Texas, Dallas, 2005
Research Interests: Human Computer Interaction, Mobile Computing, Software Engineering

**Juan (Jen) Li, Ph.D.**
University of British Columbia, 2008
Research Interests: Large-scale Distributed System (P2P and Cloud Computing, Distributed Search, Routing Algorithms), Semantic Web Technologies, Social Networks, Information Retrieval, Knowledge Discovery

**Simone Ludwig, Ph.D.**
Brunel University, 2004
Research Interests: Swarm Intelligence, Evolutionary Computation, Fuzzy Reasoning, Cloud Computing

**Kenneth Magel, Ph.D.**
Brown University, 1977
Research Interests: Software Engineering, Human-Computer Interfaces, Software Complexity, and Software Design

**Kendall Nygard, Ph.D.**
Virginia Polytechnic Institute and State University, 1978
Research Interests: Data Science, Optimization Modeling, Smart Grid, Sensor Networks, Agents, Artificial Intelligence, Security, Adaptive Systems, Swarm Intelligence

**Saeed Salem, Ph.D.**
Rensselaer Polytechnic Institute, 2009
Research Interests: Bio-Informatics and Data Mining

**Brian Slator, Ph.D.**
New Mexico State University, 1988
Research Interests: Artificial Intelligence, Educational Media

**Jeremy Straub, Ph.D.**
University of North Dakota, 2015
Research Interests: Multi-tier Mission Architecture & Control, Autonomous Data Link Reduction, Autonomous Vehicle Control, Machine Vision, Super Resolution

**Vasant Ubhaya, Ph.D.**
University of California-Berkeley, 1971
Research Interests: Algorithm Analysis, Approximation and Optimization

Gursimran Walia, Ph.D.
Mississippi State University, 2009

Changhui Yan, Ph.D.
Iowa State University, 2005
Research Interests: Bioinformatics, Computational Biology, Genomics, Machine Learning, Data Mining, Big Data, Cloud Computing

Professors of Practice

Oksana Myronovych, Ph.D.
North Dakota State University, 2009

Mark Pavicic, Ph.D.
Columbia University, 1985

Affiliate Faculty

Otto Borchert, Ph.D.
North Dakota State University, 2015
Research Interests: Artificial Intelligence, Educational Games, STEM Learning

Hyunsook Do, Ph.D.
University of Nebraska, 2007

Hassan Reza, Ph.D.
North Dakota State University, 2002
Research Interests: Software Architecture, Cloud Computing, Architectural Analysis & Description

Xiaodong Zhang, Ph.D.
Dalhousie University, Canada, 2001
Research Interests: Satellite Sensing, Geographic Information Systems