

Department of Computer Science and Engineering

Main Departmental Office
Discovery Park, Room F201
3940 N. Elm

Mailing address:
1155 Union Circle #311366
Denton, TX 76203-5017
940-565-2767

Web site: www.cse.unt.edu

Ian Parberry, Interim Chair

Graduate Faculty: Akl, Brazile, Buckles, Dantu, Gomathisankaran, Huang, Jacob, Kavi, Mihalcea, Mikler, Mohanty, Oh, Parberry, Renka, Shahrokhi, Sweany, Swigger, Tarau, Tsatsoulis, Yuan.

The Department of Computer Science and Engineering offers graduate programs leading to the following degrees:

- Master of Science with a major in computer engineering;
- Master of Science with a major in computer science, and
- Doctor of Philosophy with a major in computer science and engineering.

Information regarding these degree programs, including admission requirements and degree requirements, can be obtained from the department's web site.

The objective of the master's degree is to produce professional computer scientists capable of contributing technically to the basic core areas of computer science and computer engineering as well as to application areas. The objective of the doctoral degree is to produce professionals capable of conducting and directing research within the discipline of computer science and engineering.

The department is committed to overall excellence in graduate education. Consequently, the programs of study for these degrees include a mixture of course, laboratory and research work designed to place graduates at the forefront of technical excellence.

The department also supports an interdisciplinary doctorate with a major in information science. See the Department of Library and Information Sciences section of this catalog for more information.

Research

The Department of Computer Science and Engineering has a comprehensive research program. Current faculty research interests include theoretical computer science, databases, game programming, wired and wireless networks, computer security, artificial intelligence, natural language processing, computer systems architecture, agent-based systems, collaborative learning, parallel and distributed processing, numerical analyses, wireless communication, image understanding, sensor fusion, data mining, evolutionary computation, computational epidemiology, VLSI design, medical imaging, compilers, algorithm analyses, human factors, cryptography and bioinformatics.

The **Network Security Laboratory** was established to increase general wireline and wireless security awareness of computer science and engineering graduates, to produce skilled security specialists, and to conduct research and development activities to advance the state-of-the-art in wireline and wireless security and communication.

The **Computer Systems Research Laboratory** investigates multi-core and multi-threaded processor architectures, compiler optimizations, improving memory systems performance, low power architectures, and real-time and embedded systems. Numerous workstations, multi-core servers and large storage servers, as well as simulators, instrumentation and profiling tools, are available for researchers.

Intelligent Distributed Software Systems provides the software and hardware infrastructure for research and graduate teaching in new and exciting areas such as intelligent mobile agents, distributed artificial intelligence and Internet programming.

The **Laboratory for Recreational Computing (LARC)** serves as a center for research, education and development in the field of video game programming.

The **Geometric Computing Laboratory** conducts research to improve the theoretical efficiency of algorithms with particular focus on problems arising from geometric problems. GCL has been successful in mentoring students and involving them in synergistic activities associated with international conferences funded by UNT/National Science Foundation.

The **Language and Information Technologies Laboratory** focuses on research on natural language processing, information retrieval, and applied machine learning, with current projects covering a number of topics in lexical semantics, graph-based natural language processing and information retrieval, and multilingual natural language processing.

The **VLSI Design and CAD Laboratory (VDCL)** carries out research in design and CAD for low-power, high-performance nano-scale digital and analog/mixed-signal VLSI circuits.

The **Computational Epidemiology Research Laboratory (CERL)** applies computational science paradigms to the domain of public health, thereby providing tools for epidemiologists and public health researchers. CERL is part of CeCERA (the UNT Center for Computational Epidemiology and Response Analysis).

The **Wireless Sensor Laboratory (WiSL)** was established with the following mission: to increase general wireless communications awareness among computer science and engineering graduates, produce skilled wireless specialists, and conduct research and development activities to advance the state-of-the-art in wireless sensors.

NSF Net-Centric Software and Systems Industry/University Cooperative Research Center (Net-Centric IUCRC) is an NSF-sponsored center and currently involves UNT, UT-Dallas, Southern Methodist University, Arizona State University and nearly 20 industrial members researching and developing Net-Centric software and systems technologies. Current projects include service compositions, assuring software quality and safety, data and information integration, multi-core and many core systems, detecting abnormal events in systems, and security architectures for embedded systems.

The **Computer Vision and Intelligent Systems (CoVIS) Laboratory** seeks to advance the understanding of the theories of machine learning for processing complex data and to develop applications in areas such as medicine and geo-information. The center's research focuses on both algorithm innovation and hardware integration, which includes computer vision, pattern recognition, data mining, and artificial intelligence. The CoVIS lab is facilitated with state-of-the-art computing resources and various imaging technologies. The lab provides both graduate and undergraduate students a unique, collaborative research cohort to further their career goals.

The **Information Management and Knowledge Discovery Lab (IMKD)** focuses on information processing and data mining for emerging applications (e.g., spatial, spatio-temporal, streaming, web and sensor databases). Current projects include a number of topics in spatial data mining, geo-stream processing, modeling network similarity, trajectory modeling and privacy preserving. The lab conducts both fundamental and applied research and development to enable the use of information technology for many application domains, such as environmental monitoring, transportation and social networking.

The **Multimedia Information Laboratory** conducts research on multimedia (videos and images) processing, multimedia information extraction, and multimedia information modeling and retrieval, which includes video and image segmentation, motion and color analysis, image quality analysis, and object recognition by region clustering and classification. The lab is one of the pioneers in medical image and video processing, and it pursues cutting-edge research on various endoscopies.

The **Trusted Secure Systems Laboratory** conducts research on building trusted and secure computing systems.

Faculty research has been supported through grants from federal and state institutions and private industry including the National Science Foundation, Texas Department of Transportation, Texas Higher Education Coordinating Board, Oak Ridge National Laboratory, Google and Microsoft. The department enjoys a friendly working relationship with local and national companies. The department's Advisory Council is composed of representatives from government agencies and high-tech firms. During the past few years they have helped obtain research funding, fellowships and internships for students in the department.

Degree Programs

The department offers graduate programs leading to the following degrees:

- Master of Science with a major in computer engineering;
- Master of Science with a major in computer science, and
- Doctor of Philosophy with a major in computer science and engineering.

Information regarding these degree programs, including admission requirements and degree requirements, can be obtained from the department's web site.

Admission to graduate degree programs in computer science and computer engineering is competitive. Applications, complete with transcripts, GRE scores (UNT computer science and engineering graduates are exempt.) and TOEFL scores, must reach the computer science and engineering department by the following dates to be considered for the term/semester indicated.

October 1 — spring term/semester
March 1 — fall term/semester

Note that fall applications must be received by March 1 in order to be considered for an assistantship. Students must submit a completed application for assistantship by the above deadline to be considered for financial assistance. Applications are available on the department's web site.

Computer Engineering Program Master of Science

The department offers the Master of Science with a major in computer engineering.

Admission Requirements

Admission requirements for the MS with a major in computer engineering will be the same as the requirements for the MS with a major in computer science (see below).

Admission to Candidacy

After removal of all deficiencies and upon completion of all the leveling courses (as described below), the student is required to submit a formal degree plan to his or her advisor and the Dean of the School of Graduate Studies. Failure to fulfill this requirement may prevent the student from enrolling the following term/semester. Admission to candidacy is granted by the Dean of the School of Graduate Studies after the degree plan has been approved.

Leveling Courses

- Mathematics through multivariable calculus
- Physics including mechanics, electricity and magnetism
- CSCE 2050, Computer Science III
- CSCE 3600, Principles of Systems Programming
- CSCE 3612, Embedded Systems Design
- CSCE 3730, Reconfigurable Logic
- EENG 3510, Electronics I (Devices and Materials)

All entering students must demonstrate knowledge of the material covered in these courses. An entering student may demonstrate knowledge of the material by:

- Completing the courses at UNT
- Completing similar courses at another institution
- Evidence based on employment experience

A student may be required to successfully pass a placement exam to demonstrate their knowledge of the material.

Degree Requirements

Option A: Thesis Option (31 hours that include CSCE 5020 and 6 hours of thesis). Leveling courses cannot be counted.

Option B: Course Option (37 hours that include CSCE 5020 and may include 3 hours of project or 6 hours of problem in lieu of thesis). Leveling courses cannot be counted.

Course Selection

- Leveling course(s) are required if applicant does not have a BS with a major in computer engineering.

- Select one core course from three of the four specialty areas.
- Select at least three courses from one area; at least one of these should be a 6000-level course.
- No more than 3 hours in non-organized class (such as individual study).
- As an introduction to the department, and to research and computer engineering in general, every master's-level student must take CSCE 5020, Current Research in Computer Science and Engineering, during the first long term/semester enrolled in graduate classes. One hour of credit is obtained from this course.

Academic Standards

If a student's GPA on all graduate and/or deficiency courses falls below 3.0, the student will be placed on probation the following term/semester. Students who cannot raise their GPA above 3.0 during that term/semester will be dropped from the program. To qualify for the master's degree, the student must earn a grade of B or better in each of the core courses.

Course Requirements

Area 1: VLSI

- CSCE 5730, Digital CMOS VLSI Design (core course)
- CSCE 5750, VLSI Testing
- CSCE 5760, Design for Fault Tolerance
- CSCE 6610, Advanced Computer Architecture
- CSCE 6730, Advanced VLSI Systems

Area 2: Communication and Networks

- CSCE 5510, Wireless Communications (core course)
- CSCE 5520, Wireless Networks and Protocols
- CSCE 5530, Computer Network Design
- CSCE 5540, Introduction to Sensor Networks
- CSCE 5570, Digital Communications
- CSCE 5580, Computer Networks (core course)
- CSCE 6581, Advanced Computer Networks
- CSCE 6590, Advanced Topics in Wireless Communications and Networks

Area 3: Real-Time Systems

- CSCE 5440, Real-Time Software Development
- CSCE 5620, Real-Time Operating Systems
- CSCE 5640, Operating System Design (core course)
- CSCE 6620, Advanced Real-Time Operating Systems
- MSES 5310, Industrial Process Controls
- MSES 5330, Instrumentation System Design

Area 4: Computer Systems

- CSCE 5160, Parallel Processing and Algorithms
- CSCE 5450, Programming Languages
- CSCE 5610, Computer System Architecture (core course)
- CSCE 5640, Operating System Design
- CSCE 5650, Compiler Design
- CSCE 6450, Advanced Programming Languages
- CSCE 6610, Advanced Computer Architecture
- CSCE 6640, Advanced Operating Systems
- CSCE 6650, Advanced Compiler Techniques

General Courses

- CSCE 5900-5910, Special Problems
- CSCE 5932, Internship
- CSCE 5934, Directed Study
- CSCE 5950, Master's Thesis

Computer Science Program**Master of Science**

The department offers the Master of Science with a major in computer science.

Admission Requirements

The student must satisfy all the general admission requirements of the Toulouse School of Graduate Studies as well as the following admission requirements of the computer science and engineering department:

1. the Graduate Record Examination (GRE); contact the department or the Toulouse School of Graduate Studies for information concerning typical admission test scores;
2. for applicants whose native language is not English, UNT graduate school guidelines will be followed;
3. a GPA of at least 3.0 on the most recent 60 hours of course work;
4. completion of a sufficient amount of prior work in the field of computer science, including courses equivalent to CSCE 2610, CSCE 3110, and CSCE 3600; some undergraduate leveling sequences are available; and
5. at least 15 hours of mathematics, including differential and integral calculus, discrete mathematics and two other courses selected from statistics, linear algebra, abstract algebra, logic, numerical analysis and differential equations.

An overall evaluation of the student's credentials is used as a basis for admission. Students with an insufficient computer science background may be provisionally admitted to the program and may enroll in graduate-level courses once any required leveling courses are completed with a grade of B or

better. Admission is competitive, and satisfaction of the minimum requirements does not guarantee admission.

Admission to Candidacy

After removal of all deficiencies and upon completion of an additional 12 hours of graduate credit, the student is required to submit a formal degree plan to his or her advisor and the dean of the School of Graduate Studies. Failure to fulfill this requirement may prevent the student from enrolling the following term/semester.

Admission to candidacy is granted by the dean of the School of Graduate Studies after the degree plan has been approved.

Degree Requirements

The computer science and engineering department offers two master's degree options:

Option A: Thesis Option (31 hours that include CSCE 5020 and 6 hours of thesis).

Leveling courses cannot be counted toward the degree plan hours.

Option B: Course Option (37 hours that include CSCE 5020 and may include 3 hours of project or 6 hours of problem in lieu of thesis). Leveling courses cannot be counted toward the degree plan hours.

Course Selection

As an introduction to the department and to research in computer science and engineering, all master's students must take CSCE 5020, Current Research in Computer Science and Engineering, during the first semester they are enrolled in graduate classes.

All master's students in computer science must complete CSCE 5150, Analysis of Computer Algorithms. The remaining courses and areas of specialization are selected in consultation with the student's advisor.

Minor

From 6 to 12 hours of graduate work in a minor field of computer science application are required. With prior approval of the graduate coordinator, this work may be done outside the computer science and engineering department.

Academic Standards

If a student's GPA on all graduate and/or deficiency courses falls below 3.0, the student will be placed on probation the following term/semester. Students who cannot raise their GPA above 3.0 during that term/semester will be dropped from the program. To qualify for the master's degree, the student must earn a grade of B or better in each of the core courses.

Graduate Minor in Computer Science

A graduate minor in computer science requires 9 to 12 hours of graduate credit. CSCE 5011-5013 are service courses designed for students who are not computer science majors. Since these are introductory courses, only one of these courses is allowed in the 9-hour minor option, and no more than two of these courses may be included in the 12-hour minor option.

Computer Science and Engineering Program

Doctor of Philosophy

The program of study for the doctoral degree with a major in computer science and engineering includes formal course work, independent study and research. The purpose of the degree is to produce a professional capable of directing and conducting research within the discipline of computer science and engineering.

Admission Requirements

Students seeking admission to the doctoral program must meet all general requirements for doctoral candidates at UNT and must have completed all of the requirements (or equivalent work) for the master's degree as defined in the previous section. Additional requirements are delineated below:

1. an acceptable score on the Graduate Record Examination (GRE); contact the department or the Toulouse School of Graduate Studies for information concerning acceptable admission test scores;
2. a 3.5 GPA on the most recent 30 hours of course work;
3. for applicants whose native language is not English, a TOEFL score of at least 580 for the written test or 237 for the computer test is required; and
4. three letters of recommendation.

An overall evaluation of the student's credentials is used as a basis for admission. Admission is competitive, and satisfaction of the minimum requirements does not guarantee admission.

Degree Requirements

In addition to satisfying the general requirements for all UNT doctoral degrees listed in this catalog, each PhD student must satisfactorily complete the following:

1. A minimum of 12 hours of 6000-level organized courses in computer science and engineering;

2. The residence requirement, consisting of two consecutive terms/semesters of enrollment in at least 9 semester hours other than thesis or dissertation hours;

3. PhD qualifying requirements:

- a. Formation of a PhD committee after, at most, four long semesters. This committee shall consist of the student's advisor (major professor) and at least three additional members.
- b. Students must have a copy of their degree plan, complete and approved by the Graduate School.
- c. Student shall complete, with a grade of B or higher, a theoretical course (such as Analysis of Algorithms) that is recommended/approved by the student's PhD committee.
- d. Tool Requirement: an oral exam to be conducted by the student's PhD committee to assure the research readiness of the candidate. The format of this oral exam is to be determined by the student's PhD committee. Unless specified otherwise, the research presentation as part of the research readiness exam will serve as the tool requirement.
- e. Student shall complete the qualifying examination requirements as outlined by the CSCE "Results of PhD Qualifying Examination" requirements form (located in the CSCE main office).
- f. Results of the qualifying examination and the assessment of the student's research readiness shall be recorded in part II of this form, signed by the committee and submitted to the graduate secretary for processing.

4. Dissertation Proposal Defense: an oral presentation of a detailed research plan. The research plan (prospectus) is distributed to the committee well in advance, and an examination announcement will be distributed for interested graduate faculty and students.

5. Dissertation Defense: upon completion, the dissertation is to be distributed to the committee members at least four weeks prior to the final examination date. The candidate will prepare a formal presentation of their dissertation research and results to be defended during an oral exam.

6. Upon completion of the dissertation defense, the student shall be required to present at a departmental colloquium. The colloquium is different from the dissertation defense and prepares the candidate to present his or her research to a broader audience.

Pass-Through Master's (30 hours of course work)

Pass-through degree only. Students who have completed the comprehensive exams may apply for this option after the completion of 40 hours in the doctoral program.

Courses of Instruction

All Courses of Instruction are located in one section at the back of this catalog.

Course and Subject Guide

The "Course and Subject Guide," found in the Courses of Instruction section of this book, serves as a table of contents and provides quick access to subject areas and prefixes.

Department of Electrical Engineering

Main Departmental Office
Discovery Park, Room B270

Mailing address:
1155 Union Circle #310470
Denton, TX 76203-5017
940-891-6872
Fax: 940-891-6881

Web site: www.ee.unt.edu

Murali Varanasi, Chair

Graduate Faculty: Acevedo, Fu, Garcia, Guturu, Li, Mehta, Namuduri, Varanasi, Wan, Zhang.

Introduction

The Department of Electrical Engineering at the University of North Texas commits to achieving excellence in research and graduate education in major electrical engineering areas. Our primary goals include: (1) to provide high quality innovative educational programs at the undergraduate and graduate levels to foster learning, ethical standards, and leadership qualities; (2) to pursue excellence in research at the frontiers of electrical engineering; (3) to facilitate access to our faculty expertise and our modern facilities, and (4) to serve the industry, the profession, and other constituents in North Texas, the state and the nation.

Research Laboratories

The Department of Electrical Engineering has state-of-the-art instructional and research laboratories and software to provide practical and advanced hands-on experiences. Some laboratories and instrumentation from other departments are also available for interdisciplinary work.

The **Analog, RF and Mixed-Signal Design Laboratory** supports teaching, research and development of RF, microwave systems and antenna designs. Researchers in this laboratory design, fabricate and test new RF/microwave/millimeter-wave circuits both in the board level and the chip level. Researchers also design new antennas for different applications. All activities are supported by facilities for simulations, prototyping and measurement of RF/microwave components and systems.