Handbook for Graduate Students
Department of Computer Science and Engineering
August 11, 2011
MESSAGE FROM THE DEPARTMENT CHAIR

On behalf of all of the faculty and staff, we welcome you to the Department of Computer Science and Engineering at USC. We hope that your graduate study will be rewarding, instructive, and successful! This handbook is written to explain the regulations affecting you while you are a student at USC and to maximize your educational experience as you progress towards earning a degree. You will find additional help from the Graduate Director and members of the Graduate Committee, but feel free to ask any of us for guidance about anything in the handbook or for help if you have any problems.

We look forward to your success as a graduate student. Welcome to USC!

Prof. Michael N. Huhns, Interim Chair
This handbook is designed to provide students at the University of South Carolina information about graduate studies in the Department of Computer Science and Engineering. It includes details about the academic procedures of the department, various degree requirements, curricula, courses and many of the rules and regulations followed by the department. Many details are also available on the CSE Graduate page http://www.cse.sc.edu/graduate. Additional information about the University is contained in the USC graduate bulletin, which is available from the graduate school and accessible from the WWW at URL http://www.gradschool.sc.edu/ . There is also substantial information at the CSE Department’s Website: http://www.cse.sc.edu .

THE DEPARTMENT

In October 1999 the University merged the Computer Engineering program with the Department of Computer Science to form the Department of Computer Science and Engineering. There are 21 faculty in the department with a wide variety of research interests as indicated in the faculty profiles that appear later in this section. Last year there were 109 graduate students and approximately 71 graduate assistants that were supported by the Department performing research and instructional activities. The amount of funding for research assistants has recently surpassed that for all teaching assistant categories. In the past other departments at USC have supported almost as many computer science graduate students as the Department supports. There are also a number of industrial research assistantships. The Department offers comprehensive programs leading to the Master of Engineering, Master of Science and Doctor of Philosophy degrees in Computer Science and Engineering. The department also offers the Master of Software Engineering and a Certificate in Information Assurance and Security. The graduate programs provide a broad curriculum with many different areas of research.

Organization of the Department

The administrative officers of the Department are the Chair, the Director of Graduate Studies, the Director of Undergraduate Studies, the Business Manager and the Office Manager. Faculty committees supervise various departmental functions. The graduate committee, headed by the Director of Graduate Studies, is responsible for all aspects of the graduate program: it reviews students’ academic progress, approves all curriculum development and revisions at the graduate level before sending them to the faculty of the Department, and serves as an initial body for hearing student petitions and grievances.
**Department Personnel**

Interim Chair: Dr. Michael Huhns  
Office: 3A01 Swearingen    Phone: (803) 777-2880

Chair Administrative Assistant: Ms. Barbara Ulrich  
Office: 3A01 Swearingen    Phone: (803) 777-2880

Graduate Director: Dr. Manton M. Matthews  
Office: 3A57 Swearingen    Phone: (803) 777-3285

Director of Graduate Admissions: Dr. Srihari Nelakuditi  
Office: 3A57 Swearingen    Phone: (803) 777-3285

Graduate Secretary: Kelli Kelleher  
Office: 3A01 Swearingen    Phone: (803) 777-7849

Undergraduate Director: Dr. Jose Vidal  
Office: 3A44 Swearingen    Phone: (803) 777-8103

Business Manager: Ms. Ann Humphries  
Office: 3A50 Swearingen Phone: (803) 777-7379

Office Manager: Ms. Randi Baldwin  
Office: 3A01 Swearingen    Phone: (803) 777-7979

Undergraduate Advisor: Ms. Catherine Matthews  
Office: 1A01D Swearingen Phone: (803) 777-2427

System Manager: Mr. Patrick O’Keefe  
Office: 1D28 Swearingen Phone: (803) 777-4611

College Network Administrator: Ms. Veronica Wilkinson  
Office: 1D Swearingen Phone: (803) 777-5713

Graduate Committee:

Dr. Jianjun Hu  
Dr. Manton Matthews  
Dr. Srihari Nelakuditi  
Dr. John Rose  
Dr. Jijun Tang  
Dr. Yan Tong  
Dr. Homayoun Valafar  
Dr. Wenyuan Xu
Faculty Research Interests


Jason Bakos, Ph.D., University of Pittsburgh, 2005. Computer Architecture, VLSI.


Manton M. Matthews, Ph.D., University of South Carolina, 1980. Natural Language Processing, Parallel computing, Graph Theory.


Jijun Tang, Ph.D., Univ. of New Mexico, 2004. Algorithm Design and Analysis, Computational Biology and Bioinformatics, Computer Games and Simulation.

Yan Tong, Ph.D., Rensselaer Polytechnic Institute (2007), computer vision and pattern recognition especially on human computer interaction.
Homayoun Valafar, Ph.D., Purdue University, 1995. Bioinformatics, Medical Informatics, Computational Biology, Artificial Intelligence, Optimization, and Parallel Algorithms and Architectures.


Computational Facilities
The department runs several labs of workstations in the Swearingen Engineering Center and in Sumwalt. These are grouped logically by machine type as opposed to physical location. The instructional machines are spread throughout Swearingen and are summarized in the following table.

<table>
<thead>
<tr>
<th>Room</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWG 1D11</td>
<td>Windows Lab</td>
</tr>
<tr>
<td>SWG 1D15</td>
<td>Windows Lab</td>
</tr>
<tr>
<td>SWG 1D29</td>
<td>Windows Lab</td>
</tr>
<tr>
<td>SWG 1D39</td>
<td>Linux/Mac Lab</td>
</tr>
<tr>
<td>SWG 3D22</td>
<td>Windows Lab</td>
</tr>
<tr>
<td>Sumwalt 244</td>
<td>Windows Lab for 101/102</td>
</tr>
<tr>
<td>Sumwalt 361</td>
<td>Windows Lab for 101/102</td>
</tr>
</tbody>
</table>

Departmental Instructional Facilities
Additional information can be found [http://www.cse.sc.edu/local](http://www.cse.sc.edu/local). The departmental machines are operated 24 hours per day, and graduate students have access to them via combination locks on the lab doors and keys. Accounts on Departmental machines are assigned to students at the first occasion they are needed, and are kept active as long as the student remains enrolled. During the second week of each fall and spring semester, accounts for students that are no longer enrolled are deactivated.

The college also manages two mid-range Linux clusters and one shared-memory SGI super computer. Students engage in research can request access to these machines through their research advisors.

Calendar
Orientation: An orientation program for graduate students is conducted by the Department each semester approximately one week before classes begin. At this meeting the graduate director will provide an overview of the degree programs and the courses for the upcoming semester. Attendance is suggested but not required.

Preregistration: Each November and April the University holds preregistration for classes for the following semester. Students must be advised before they can register. Make an appointment with your advisor in the weeks just prior to pre-registration, and then register as soon as possible. Students receiving financial support from the department are required to pre-register during this pre-registration period.

Fee Payment Deadlines: Fees for the current year appear on the Bursar’s website, http://www.sc.edu/bursar/schedule_columbia.shtml. If fees are not paid by a certain date and time set by the University, the student’s enrollment will be cancelled and the student must repeat the registration process. The cancellation dates are listed in the Master Schedule of Classes. You should not register for more courses than you plan to take, as the university sets your bill based on the number of hours for which you are registered.

Drop/Add Deadlines: During the first week of classes students may use VIP (http://www.vip.sc.edu/) to rearrange their schedules. The schedule at the end of the first full week of classes becomes the schedule that will appear on the transcript. Up until the end of the sixth week of classes, a class may be dropped without a penalty grade. The course will appear on the transcript with a grade of ‘W’. When a student withdraws after the sixth week, a penalty grade of ‘WF’ is assigned. These dates are published in the Master Schedule of Classes http://registrar.sc.edu/html/course_listings/ and strictly enforced by the Graduate School.

Tuition and Fees: Fees for the current year appear on the Bursar’s website, http://www.sc.edu/bursar/schedule.html For the 2011-2012 academic year, tuition for full-time (12 or more hours) graduate students is $4,718 for South Carolina residents and $10,168 for non-residents. The part-time tuition for South Carolina residents is $467 per semester hour and $992 per semester hour for non-residents. The tuition for graduate assistants is reduced to the in state rate and will usually be further supplemented by the department. The University requires that all graduate assistants take at least six graduate hours in order to receive an assistantship. There is also a technology fee for all full-time students.

THE GRADUATE PROGRAMS
Research activities are a main thrust of the graduate programs. Graduate students can participate in a large number of research activities. Research interests of present faculty include artificial intelligence, distributed agents, computational science, security, bioinformatics, reconfigurable computing, the semantic web, computer vision, simulation, parallel algorithms, theoretical computer science, pattern recognition, database management, architecture, multiprocessor and distributed systems, computational linguistics, and information retrieval.
Admission Requirements to the Graduate Programs

Applications must be received by February 1 for fall admission and by October 1 for spring admission. Each application will be evaluated by the admissions committee and then the Department will officially make a recommendation to the Graduate School which makes the final decision and notifies the applicant of the decision. An applicant who fulfills the following minimum requirements may be granted admission. However, admission is competitive and not all candidates satisfying the minimal standards will be admitted.

1. An undergraduate degree from a college or university of recognized standing is required with a B average or better for all work completed (i.e., a grade point average of at least 3.0 on a 4.0 scale),
2. The applicant should have a good background in Computer Science or Computer Engineering. (The USC undergraduate courses corresponding to these requirements appear in brackets.)
   1. Two courses in programming with emphasis on structured programming and on elementary data structures [CSCE 145, 146]
   2. Computer Organization [CSCE 212]
   3. Introduction to analysis of algorithms [CSCE 350]
   4. Operating Systems [CSCE 311]
   5. Mathematical foundations: Discrete Mathematics [MATH 174], Calculus I and II [Math 141, 142].

   The applicant should provide details of this background information on the Graduate Admission Evaluation Form and provide transcripts of all academic work.

3. An official copy of the Graduate Record Examination (GRE) is required. We expect international applicants to achieve scores of at least 500 on the Verbal section, 700 on the Quantitative section, and 4.0-4.5 on the Analytical Writing section.

4. International applicants must attain a score of 570 or better on the Test of English as a Foreign Language (TOEFL).

5. The student must supply two letters of recommendation, preferably from prior professors. No application can be evaluated until the Department receives the above information, and a completed application form. Undergraduate and other relevant transcripts should be translated into English, if necessary. Electronic applications can be filled out at the URL http://www.gradschool.sc.edu.

Conditional Admission: An applicant who clearly has good potential for success in the graduate program but does not satisfy the computer science background requirements may be granted Conditional Admission. Conditionally admitted students will be required to complete a set of courses specified by the Graduate Director before they can petition for regular status. Students who have not yet taken the GRE will not be admitted in this category. After students complete the background requirements they will be granted regular admission status.

Non-degree Admission: Any student who has an undergraduate degree and can profit by taking graduate courses in Computer Science, but who does not intend to work towards an advanced degree in Computer Science, may be admitted by the graduate school as a non-degree candidate.

Some restrictions apply to the courses one is allowed to register for while holding non-degree status. Also, there is a limit of two courses taken as a non-degree student that may be applied
to a graduate degree. Clearance from the Graduate Director must be obtained prior to registration. This category is NOT available for international applicants.

Master of Science in Computer Science and Engineering
The Master of Science degree in Computer Science and Engineering requires 25 hours of course work beyond the B.S., six hours of thesis preparation (CSCE 799), and a thesis. This coursework must include CSCE 513, CSCE 531, CSCE 750, CSCE 791 (1 hour) and an additional nine hours in CSCE courses numbered above 700. A maximum of six hours in non-CSCE courses may be applied toward the degree. Of the CSCE hours at most three hours of CSCE 798 and no hours of CSCE 797 may be included. The student must defend the thesis in a public presentation.

Master of Engineering in Computer Science and Engineering
The professional Master of Engineering degree in Computer Science and Engineering requires 30 hours of course work beyond the B.S. This course work must include CSCE 513, CSCE 531, CSCE 750, CSCE 791 (1 hour) and an additional twelve hours in CSCE courses numbered 700 and above. A maximum of six hours in non-CSCE courses may be applied toward the degree. Of the CSCE hours at most three hours of CSCE 798 and no hours of CSCE 797 may be included. As a professional degree there is a comprehensive exam requirement that is fulfilled with a comprehensive examination on the core courses. This exam is offered on Reading Day after the Fall and Spring semesters.

Master of Engineering in Software Engineering
For students having adequate experience in software development or maintenance, the MSE degree requires 30 hours of course work consisting of 15 hours in required software engineering courses, 15 hours of elective courses from the approved list below, and satisfactory completion of a written comprehensive software engineering exam. Students must also submit a report on some aspect of software engineering that demonstrates mastery of the subject and a high level of communication skills.

The required core courses for the MSE program are:
- CSCE 740 Software Engineering
- CSCE 741 Software Process
- CSCE 742 Software Architectures
- CSCE 743 Software Requirements
- CSCE 747 Software Testing and Quality Assurance

Software Engineering Elective Courses (15 hours) are to be chosen from the following list:
- CSCE 510 System Programming
- CSCE 512 System Performance Evaluation
- CSCE 516 Computer Networks
- CSCE 520 Database System Design
- CSCE 547 Object Oriented Programming
- CSCE 725 Information Retrieval Algorithms and Models
- CSCE 744 Object-Oriented Analysis and Design
- CSCE 745 Object-Oriented Programming Methods
- CSCE 721 Physical Database Design
Certificate of Graduate Studies in Information Assurance and Security

The graduate certificate program in information assurance and security requires at least 18 hours of graduate study, at least half of which must be courses at the 700 level or above with the CSCE designator, completed within a period of six years before the award of the certificate. The 18 hours must include the three core courses: CSCE 522 Information Security Principles, CSCE 715 Network Systems Security, and CSCE 727 Information Warfare. At least 9 hours of additional courses must be selected with the approval of the director of graduate studies. Up to 6 hours of appropriate courses may be taken from other departments and/or by transfer credit. The Graduate School also limits the number of hours that may be included in another master’s degree to 9 hours. Thus to complete a masters and the certificate requires at least 39 carefully selected hours.

Milestones and Forms:

The Department has a collection of milestone forms that insure that students make steady progress towards completing their degrees. Copies of each of these forms are available online.

<table>
<thead>
<tr>
<th>Masters Degree Forms</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Advisor</td>
<td>Before Advisement/Preregistration Period of first semester</td>
</tr>
<tr>
<td>Thesis Advisor *</td>
<td>During the semester the student will complete twelve graduate hours.</td>
</tr>
<tr>
<td>Program of Study</td>
<td>During the semester the student will complete twelve graduate hours.</td>
</tr>
<tr>
<td>Thesis Committee *</td>
<td>Before thesis proposal scheduling form</td>
</tr>
<tr>
<td>Thesis Proposal Scheduling *</td>
<td>One week before Proposal</td>
</tr>
<tr>
<td>Thesis Proposal Approval *</td>
<td>60 days before scheduling the thesis defense</td>
</tr>
<tr>
<td>Thesis Defense Scheduling *</td>
<td>14 days before the defense</td>
</tr>
</tbody>
</table>

* Only applies to M.S. students, not M.E. or M.S.E. students.

Program of Study

Every student must file a program of study that is approved by his/her advisor, the Graduate Director, and the Dean of the Graduate School. A program of study is a list of courses that fulfill all the requirements for a degree and when it is approved the student is assured that this is all that needs to be done to complete the degree. Students should consult their advisor to select an appropriate sequence of courses for their program of study. International students should note that the Graduate School requires that they file a program of study before the registration period during their first semester.
M.S. Thesis Requirement

A thesis is required for all M.S. degrees offered at the University. The M.S. thesis is a monograph, describing the student's research or project. The thesis is a significant original research paper of sufficient quality to be published in a refereed journal or be presented at one of the major Computer Science/Computer Engineering conferences. It is expected that the work done in a thesis of this nature could be developed into research that has suitable depth for a Ph.D. dissertation. The investment of time by both the thesis advisor and the student should be significant. Thus, students who are interested in preparation for doctoral study will be encouraged to write a thesis. In turn, to reflect the increased investment in time on the part of the student and advisor, the student is required to register for (3) additional thesis credits, in lieu of additional courses that students pursuing the ME degree must take.

Thesis Committee: A student may register for CSCE 799 only after completing the Thesis Advisor form (CSE 1). Students in the research option are recommended to register for 3 hours of CSCE 799 in each of two semesters. During the first semester, after a topic is selected and the area of the thesis is clearly defined, the student should form a thesis committee. The thesis committee should consist of at least three members of the graduate faculty including the thesis advisor. The thesis advisor and a majority of members must be from the Computer Science and Engineering Department. The Thesis Committee form (CSE 2) should be completed at the time of the formation of the thesis committee.

Thesis Proposal: A proposal that outlines the scope of the M.S. thesis must be prepared in consultation with the advisor and thesis committee. An oral presentation of the proposal must be made to the thesis committee. The proposal presentation is open to the public and needs to be scheduled one week ahead by turning in a copy of the proposal and a Proposal Scheduling Form to the Graduate Secretary.

After the committee agrees that the thesis proposed is acceptable, they sign the Thesis Proposal Approval form. This proposal is then filed in the student's folder maintained in the graduate office. It is the responsibility of the student to present a thesis proposal by the end of the first semester in which he/she is registered for CSCI 799 in the Research option. For the Project option, the thesis proposal should be presented no later than 4 weeks into the semester.

Selecting a Date for the Thesis Defense: Copies of the final draft of the written thesis must be submitted to members of the thesis committee at least two weeks before the final defense. In addition, a copy of the thesis must be submitted to the Graduate Secretary along with a written request on the Thesis Defense Scheduling form (CSE 4) to set up a date for the thesis defense. The defense must be scheduled to start between 9:00 a.m. and 5:00 p.m. on a day in which the University is in session. The date of the thesis defense will be set no earlier than two weeks from the date of the filing of the Thesis Defense Scheduling form. This is necessary to give the committee members and other members of the Department adequate time to read the final version of the thesis. The copy submitted to the Graduate Secretary will be made available online for public reference. The CSE 4 form cannot be filed earlier than at
least 60 days after the Thesis Proposal form is filed and must be filed at least two weeks before the scheduled defense date.

**Thesis Defense:** A final oral examination covering the thesis and relevant course work must be passed. A member of the thesis committee other than the thesis advisor will act as the examination chair. The examination chair is responsible for administering the final exam. After the oral exam has been conducted, the examination chair writes a report, which is approved and signed by all members of the student's committee. This report will contain a record of the exam and its outcome. In the event that corrections or changes of any kind to the written thesis are required, the report shall indicate in writing the method that will be adopted to complete the work. It is the responsibility of the examination chair to insure that any changes stipulated in the report are made before notifying the Graduate Director that the student has completed his/her final examination successfully. After successful completion of the examination, the student must submit at least three copies of the approved thesis to the Graduate School for binding. The University requires a copy for each of the Thomas Cooper and South Carolina Libraries and one copy must be placed in the departmental library. If the student would like a personal copy and a copy for the advisor then this brings the total needed to five. The student must make an appointment at least a week in advance to turn the thesis in to the Graduate School.

**Application for Graduation:** Application for a diploma must be made to the Graduate School early in the semester in which the degree is expected. There are deadlines by which the format of the thesis needs to be checked by the graduate school and by which the completed thesis has to be submitted to the graduate school. Students are required to make an appointment with the graduate school at least one week ahead of time to turn in their thesis. The Graduate Bulletin and the Master Schedule of Classes give University deadlines associated with applying for graduation. The graduation center page provides even more details at the URL [http://www.gradschool.sc.edu/graduation_information.html](http://www.gradschool.sc.edu/graduation_information.html). Students must be registered for at least one credit hour during the semester in which they complete their degree requirements.

**Residence Requirements:** There is a residence requirement of at least two regular semesters (or the equivalent in summer sessions) for all graduate students at the university. Nine to twelve hours constitutes the normal graduate load in a regular semester. Graduate Assistants are considered fulltime if they are registered for 6 graduate hours. The International students (non assistants) are required to enroll for a full load to maintain F-1 visa status. The only exceptions to this rule are when a student is doing all the prerequisites that can legitimately be attempted or when all coursework has been completed.

**Maximum Period Allowed:** A student must complete all degree requirements within a period of six years after being admitted to the program as a regular student. If a student requires more than six years to complete the program, special arrangements will have to be made with the Department for revalidation of courses taken by the student more than six years prior to the date of graduation. If a course has changed substantially since the time that it was originally taken, then it might not be possible to attempt to revalidate it. Students desiring revalidation must first request in writing that the Graduate Director approves the proposed plan for revalidation. For more details on revalidation, please refer to the graduate bulletin published by the Graduate School. Transfer credits may not be revalidated.
Transfer of Credit Towards the M.S.: A maximum of nine semester credit hours of graduate level courses with grades of B or better may be transferred from other institutions. The Graduate Director and the Dean of the Graduate School must approve these credits. Documentation in the form of the appropriate pages of university bulletins and official transcripts must be supplied. The normal time that transfer courses are approved is when the student files the program of study. Courses from other USC departments may be used if the advisor first approves them. There is a limit of nine hours that can be taken outside the department. Transfer credit is allowed only for courses taken within six (6) years of the expected date of completion of the M.S. program. There is no revalidation process for over-age transfer credits.

Ph.D. Program
The doctoral program in Computer Science and Engineering prepares students for research positions in academia and industry. The admission requirements for the Ph.D. program are essentially the same as those for the M.S. Program with greater emphasis on research potential. Ph.D. applicants must furnish at least two letters of recommendation, which address the issues of academic preparedness and research potential. Among eligible applicants, admission is awarded to those students who provide evidence of research potential, interest, and ability to pursue advanced studies in Computer Science and Engineering. Besides academic performance, the applicant's statement of research interest and letters of recommendation will influence the decision about admission into the Ph.D. program.

Course Requirements
Requirements for the Ph.D. degree in Computer Science and Engineering fall into four categories: course requirements, the qualifying examination, the comprehensive examination, and the dissertation. Students who enter the program with a bachelor’s degree must complete a minimum of 48 credit hours of graduate course work (excluding CSCE 799 and 899). This coursework must include CSCE 513, CSCE 531, CSCE 551, CSCE 750, CSCE 791 (1 hour) and an additional 20 hours in CSCE courses numbered above 700. For students entering with a master’s degree transfer credit is allowed but in any case these core courses are required and at least 24 course hours numbered above 700 must be taken in CSCE courses at USC. The student’s dissertation committee must approve the program of study, so this committee should be formed as early in a student’s course of study as possible. Each student is also required to register for a minimum of 12 hours of dissertation preparation (CSCE 899).

Prior to admission to candidacy, the student is required to pass a written qualifying examination. This examination is designed to test fundamental knowledge and conceptual understanding of the mainstream areas of computer science and engineering. The Ph.D. comprehensive examination combines a written and an oral examination that seeks to discover whether the student has a sufficiently deep understanding of topics in the area of interest to carry out the proposed research. After completing the research and writing the dissertation, the student must defend the work in a public presentation.

Transfer of Credit Towards the Ph.D. There is a limit of 24 semester hours of non-thesis graduate course work completed prior to admission that may be transferred towards satisfying the Ph.D. course requirements. However, transfer credit is subject to the following restrictions:

1. A grade of B or better is required for each course submitted for transfer credit.
2. Transfer credits are allowed only for courses taken within 5 years of the admission date to the Ph.D. program.
3. The petition for transfer credits, submitted no later than the first year after admission, must be approved by the Graduate Director and the Dean of the Graduate School.
4. Revalidation of transfer courses is not permitted.
5. At least 50% of the coursework on the program of study must be completed at the 700 level from our department, i.e. at least 24 course hours numbered above 700 must be in CSCE courses at USC.

Milestones and Forms for the PhD program:

The Department has a collection of milestone forms that insure that students make steady progress towards completing their degrees. Copies of each of these forms are available online at websites for forms including:

1. The Department Graduate Forms - https://www.cse.sc.edu/graduate/forms
2. The Graduate School Forms Library - http://gradschool.sc.edu/DocLibrary/
3. International Student Services - http://ip.sc.edu/iss/

<table>
<thead>
<tr>
<th>Doctoral Milestones</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualifying Exam</td>
<td>First attempt during the semester after first full-year in program</td>
</tr>
<tr>
<td>Dissertation Advisor</td>
<td>During the semester the student will complete twelve graduate hours.</td>
</tr>
<tr>
<td>Program of Study</td>
<td>During the semester the student will complete twelve graduate hours.</td>
</tr>
<tr>
<td>Dissertation Committee *</td>
<td>At the completion of the qualifying exam</td>
</tr>
<tr>
<td></td>
<td>The Graduate School requires the above four be filed one full year before graduation</td>
</tr>
<tr>
<td>Dissertation Proposal Scheduling *</td>
<td>One week before Proposal</td>
</tr>
<tr>
<td>Comprehensive Exam including</td>
<td>9 months before scheduling the thesis defense</td>
</tr>
<tr>
<td>Dissertation Proposal *</td>
<td></td>
</tr>
<tr>
<td>Dissertation Defense Scheduling *</td>
<td>14 days before the defense; final copy of dissertation to committee and department</td>
</tr>
</tbody>
</table>

Ph.D. Qualifying Examination

Prior to admission to candidacy for the degree of Doctor of Philosophy, the student is required to pass a written qualifying exam. This must be started during the student’s first full year in the PhD program. The exam is given twice a year on a Saturday at the start of the fall and spring semesters. So a student entering in the fall would be expected to take the exam at the start of the fall semester of the second year. The CSE qualifying exam is in written format and consists of three sessions:

- Session 1: Architecture or Compilers
- Session 2: Algorithms or Theory
- Session 3: Research Area: A course (as given below) related to the student’s research area.

<table>
<thead>
<tr>
<th>Course</th>
<th>Research Areas</th>
<th>Advisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>513 &amp; 531</td>
<td>Computer Architecture</td>
<td>Bakos, Buell</td>
</tr>
<tr>
<td></td>
<td>Reconfigurable Computing</td>
<td></td>
</tr>
<tr>
<td>516</td>
<td>Computer Networks</td>
<td>Nelakuditi, Xu</td>
</tr>
<tr>
<td>522</td>
<td>Information Security</td>
<td>Eastman, Farkas, Xu</td>
</tr>
</tbody>
</table>
The exam will usually take a day. The first two sessions will be offered in the morning, separated by a short break. The third session will be offered in the afternoon after a lunch break. One month before the exam, students intending to take the qualifying exam must register and choose which courses they will prepare for. Approval from the graduate committee is needed if a student intends to choose a course other than that specified above for the research area. Students will be allowed two attempts to pass this examination, and only failed areas need be retaken. If someone's research area is Architecture or Compilers or Reconfigurable Computing, they should take the exam on both 513 and 531 (one satisfying Session 1 and the other satisfying Session 3). Similarly those in Algorithms or Complexity Theory should take the exam in both 750 and 551. The examination is constructed and graded by the faculty as a whole. The final construction and approval is by the Qualifying Exam Committee, which also will make the final decision on whether the student has passed or not. All exam materials will be saved in the student’s electronic file.

**Dissertation Advisor and Committee**

Each student must form a dissertation committee to supervise his/her progress towards successful completion of the Doctoral Program. The committee shall consist of not fewer than five (5) members; including one member from some department other than Computer Science and Engineering. The dissertation advisor and the majority of the committee members must be from the Department of Computer Science and Engineering. The graduate director will appoint a CSE faculty member other than the dissertation advisor to serve as chair of the examining committee.

**Program of Study**: The dissertation committee must approve the program of study selected by the student. Towards this end, each student should schedule a meeting of the dissertation committee to ascertain a satisfactory sequence of courses in preparation for dissertation research. The committee will take in account courses that have been completed and counsel the student on courses that he/she needs to take in the future.

**Comprehensive Examination**

The Ph.D. comprehensive examination combines a written and an oral examination that serves as a test for the detailed preparation of the student; it seeks to discover whether the student has a sufficiently deep understanding of topics in the area of interest to carry out the proposed research. The written includes the preparation of a prospectus for the comprehensive examination with the help and consent of the advisor. The prospectus
contains the dissertation proposal and defines the primary and related areas to be covered by the comprehensive examination. Area definition is accomplished through course or literature citations or any other appropriate means that the student's dissertation committee finds suitable. The dissertation proposal outlines the proposed research in some detail, stating the problem, its scope, the kinds of resources required to complete the work, the methodology to be used, and the nature of expected results. A literature review in the topic of research is expected. The prospectus for the comprehensive examination must be prepared and distributed to the dissertation committee.

The examination includes an in-depth written test on the subject matter related to the student's dissertation topic. Although the exact nature of the exam is determined by the Dissertation Committee, frequently what is done is that each committee member after reading the prospectus will generate questions and submit them to the chair of the examining committee. The committee may also examine the student on any other material it deems relevant. The committee will take one of the following actions by majority vote: (i) pass, (ii) fail, or (iii) deferred decision. A written record of the vote and the examination and answers will be filed in the student's electronic folder along with supplemental comments as desired. When the committee makes a deferred decision, they will submit a detailed report stating the student's deficiencies and the prescribed course of action that will enable the student to make up these deficiencies. For example, additional course work or readings of relevant articles in the literature may be prescribed. The student will then have another chance to pass his/her written and/or oral comprehensive examination. A copy of the report is placed in the student's file and one is submitted to the graduate committee. A student who fails will be asked to withdraw from the Ph.D. program. The distinction between the fail and deferred decisions are based on the committee's evaluation of the candidate's potential for completing the doctoral program. If the decision of the committee is to pass the student, all members of the committee will sign the written prospectus and the Dissertation Proposal form, which is then filed in the student's folder and serves as the student's dissertation contract.

**Dissertation Research**

After successful completion of the comprehensive examination and most of the course requirements, each candidate must submit a doctoral dissertation outline and prospectus to the department. There is a requirement that the comprehensive exam be completed at least nine months before the defense of the dissertation. The candidate is expected to concentrate on the research necessary to complete the plan in the prospectus. This research is conducted under the supervision of the student's advisor and dissertation committee.

**Completion of the Dissertation**: When the candidate, dissertation advisor, and dissertation committee are satisfied that the research specified in the prospectus is complete, the candidate presents his/her work to the committee in the form of a typed manuscript. This manuscript must represent the student's original work; it must conform to the highest standards of accuracy, significance, methodology, and correctness of style in describing the original research. Every member of the student's dissertation committee must approve the manuscript before the student may request the final defense. The date of the defense must be at least two weeks from the date the final copy of the manuscript and CSE4-form is submitted to the Department and Committee and at least nine months after the comprehensive exam.
Public Presentation of the Dissertation: After approval of the manuscript, the candidate will request that the Graduate Director approve the schedule for the final oral defense. In order to promote attendance by faculty and graduate students, the defense must be scheduled to start between 9:30 and 3:30 during a day in which the university is in session. The Graduate Director will appoint an examination chair other than the dissertation advisor to supervise all details of the public defense. The examination chair is responsible for filing a written report to the Graduate Director conveying formal approval of the defense, as well as any changes required to render the submitted manuscript acceptable. A copy of this report is placed in the permanent folder of the candidate. When all requirements are satisfied, the examination chair will notify the Graduate Director. One electronic copy of the final dissertation must be placed in the departmental library. In addition an electronic copy of the dissertation must be submitted to the Department’s Technical Report series.

Residency Requirements: There is a residency requirement of at least three years of full-time graduate work or equivalent and at least 30 graduate hours after admission to the doctoral program. The doctoral residency requirement also stipulates that at least 18 hours must be completed within a span of three consecutive semesters. At least one year of the three must be spent on the Columbia Campus of the University of South Carolina; and all three years must be within eight calendar years of the date at which the degree is granted.

Language Requirements: The Department has no foreign language requirement.

Maximum Period Allowed: Students have eight (8) years from the date of admission into the program on a regular status to complete all requirements for the Ph.D. Degree.

ACADEMIC REGULATIONS

All graduate students are subject to the academic regulations of both the Graduate School and the Department. Departmental regulations are given in this section. The academic regulations of the graduate school are outlined in the bulletin released by the Graduate School, and located at http://www.sc.edu/bulletin/grad/index.html. Students are urged to read the pertinent sections carefully.

Advisement

Each student should select an academic advisor as soon as possible. This must be accomplished before the preregistration period of the student's first semester. All graduate students are encouraged to seek a thesis/dissertation advisor soon after entering the program. After a thesis advisor is selected, the thesis advisor will usually also fulfill the role of academic advisor. A student may change thesis advisors at any time by obtaining approval from the new advisor and informing the graduate committee of the change in writing. This written notification must contain the names of the former and the new advisor and a statement from the student that he/she has informed both advisors of the proposed change.
Periodic meetings with the student's advisor are recommended to verify status with respect to the degree requirements and to obtain information and advice in appropriate supporting courses, changes in requirements, tentative course schedules for subsequent semesters, etc.

Although the thesis or dissertation advisor and the Director of Graduate Studies play a major role in advising students, it is, nonetheless, the student's responsibility to be aware of pertinent deadlines and requirements of the Department and the Graduate School and to insure that they are met.

**Maintenance of Graduate Standing**

Each student undergoes an annual review of academic progress by the student's advisor and the graduate committee. The following general guidelines are applicable to all students:

1. Full time students enrolled in a Master's degree program are normally expected to complete all degree requirements in a period of two calendar years.
2. The Ph.D. program normally requires three years after the M.S. degree in Computer Science or Computer Engineering; otherwise it may take four to five years.
3. Full-time students are expected to be enrolled for at least nine (9) and no more than twelve (12) semester hours in both the fall and spring semesters.
4. The level of courses taken should be consistent with the stated degree program, as should the course content. The academic advisor must approve courses outside the department for graduate credit.
5. Every graduate student must maintain an overall B average (3.00 on a 4.00 point scale). Failure to maintain a 3.00 for two consecutive semesters will result in expulsion from the university, see http://www.sc.edu/bulletin/grad/GCompSci.html" Academic Suspension Policy" under "Academic Standards for Progression".
6. For graduation a student must have a 3.0 GPA on all graduate courses taken, all courses taken at the 700 level and on the courses listed on the program of study.

**Program of Study**

Master's degree candidates are required to consult their respective thesis advisors and file a program of study with the Graduate Director as soon as possible. The graduate school permits filing the program of study as early as the first semester, but the department recommends that students do so immediately after completing the Thesis Advisor form. The program of study may be modified or replaced by a new one if conditions warrant a change. The student, the thesis advisor, the Graduate Director and the Dean of the Graduate School must sign each program.

**Waiver of a Degree Requirement**

A candidate may apply for waiver of a departmental requirement if there are justified extenuating circumstances. No waiver will be granted that violates general policies of the Graduate School. The student must submit to the Graduate Committee a written petition substantiating both the necessity and justification for the requested waiver.
Revalidation of Courses

Courses taken become invalid after a period of six years. Revalidation is based on re-examination of the course content. To be eligible for revalidation, the course content must be of current value and consistent with the scope and level of the current curriculum.

Applications for Degrees

All candidates for degrees must file a formal application during the last academic term before graduation with the Dean of the Graduate School. Applications must be filed by the third week of the fall or spring semester in which the degree is to be awarded, or within the first ten days of the first summer session. The precise dates are generally published in the Master Schedule of Classes.

Diplomas will not be awarded retroactively. To pursue further study, a student must submit a new application to the Graduate School since the previous admission was specifically for the degree program completed.

Incomplete Policy and Procedures

A grade of Incomplete may be given to a student whose attendance and performance is otherwise satisfactory but who for a good and valid reason has failed to complete some portion of the course work. The faculty member will establish a deadline by which the work must be completed. If it has not been completed by this date, the grade will automatically convert to the default grade that the professor established when assigning the Incomplete, if it has not already been changed.

The decision to give an incomplete is to be made prior to the end of the term and the incomplete form submitted to the department chair along with the grade reports. When an incomplete is given to a student, the time allocated for making up the incomplete grade should be reasonable: normally no more than 30 days. Attending the course in the subsequent semester is not an acceptable means to make up an incomplete. If the grade has not been completed by the end of one year, the “I” will automatically convert to an “F”, (or whatever the instructor has assigned as the default grade).

Reasons for the incomplete should be fully explained. The following phrases are not sufficient by themselves: "unable to submit project on time", "other pressing business", "needed extra time", "personal problems", "another course interfered".

Academic Integrity

Fundamental to the principles of independent learning and professional growth is the requirement of honesty and integrity in the conduct of both academic and non-academic life. This standard applies to all academic work, including assignments, examinations, theses, projects, and dissertations. Cheating, plagiarism and other forms of intellectual dishonesty are considered serious offenses against the academic community. These offenses are summarized in the University Code of Student Academic Responsibility, which is included in the following section. In addition, students of the Computer Science and Engineering Department are expected to know and follow the professional standards set forth in the ACM Code of Professional Conduct (Communications of the ACM, October 1990).
Possible penalties for a substantiated violation include, but are not limited to the following: failing grade for the course, revocation of departmental financial support, expulsion from the Computer Science and Engineering program, and suspension from the University.

If the student admits the violation, the faculty member responsible for the course in which the violation occurs recommends the penalty to the Dean of the College of Engineering and Information Technology. The student may appeal the decision of the faculty member to the Graduate Committee. After meeting with all parties, the committee may support the recommendation of the faculty member or recommend a different penalty. However, grades for a course are the responsibility of the instructor and the instructor makes the final decision. The committee may also recommend further actions, as described in the preceding paragraph. A report of committee action will be prepared by the Graduate Director and filed in the student's folder. A copy of this report will also be filed with the Graduate School. The student can appeal the committee decision by filing a written petition to the Academic Responsibilities Committee of the College of Engineering and Information Technology or to the Graduate Council.

**Code of Student Academic Responsibility**

The following code is taken from the University Code of Student Academic Responsibility as it appears in the publication Carolina Community http://www.sa.sc.edu/carolinacommunity/

**Student Affairs Policy STAF 6.25**

University of South Carolina Honor Code http://www.housing.sc.edu/academicintegrity/honorcode.html

It is the responsibility of every student at the University of South Carolina Columbia to adhere steadfastly to truthfulness and to avoid dishonesty, fraud, or deceit of any type in connection with any academic program. Any student who violates this Honor Code or who knowingly assists another to violate this Honor Code shall be subject to discipline.

**General Provisions and Definitions http://www.housing.sc.edu/academicintegrity/policy.html**

The University of South Carolina Honor Code is the University’s policy regarding incidents involving academic integrity. The Honor Code codifies the values espoused in the tenets of the Carolinian Creed.

This Honor Code applies to all students of the University of South Carolina Columbia.

A “Student” is defined as any person who is admitted, enrolled or registered for study at the University of South Carolina for any academic period. Persons who are not officially enrolled for a particular term but who have a continuing student relationship with, or an educational interest in, the University of South Carolina are considered “students”. A person shall also be considered a student when the person is attending or participating in any activity preparatory to the beginning of school including, but not limited to, orientation, placement testing, and residence hall check-in.

An “Instructor of Record” is defined as anybody responsible for the academic evaluation of work.
A “Dean” is defined as the Dean of a school or college offering the academic program in which the alleged violation occurred or his or her designee.

The “Assistant Vice Provost* for Academic Integrity” is defined as the Associate Vice President or any member of the Office of Academic Integrity designated by the Assistant Vice Provost.

A “College Committee” is defined as the group of faculty and students who hear cases of alleged violations of the Honor Code, and is composed of faculty members selected from a pool of faculty from the college where the alleged violation occurred designated by the Dean of the College and students from the College and/or the Carolina Student Judicial Council. Faculty members are appointed annually by the Dean, and student members are selected annually according to the guidelines set in the Constitution of the Carolina Student Judicial Council, or may be appointed by the Dean of the College.

The “University Committee of Academic Responsibility” shall consider appeals cases decided by the college academic responsibility committees when any party to the case formally appeals on grounds set forth in the University Academic Disciplinary Procedures. This committee shall perform any other functions provided for in the Academic Disciplinary Procedures. This committee consists of five faculty members, two undergraduate students, and two graduate students. (University of South Carolina Faculty Manual)

The “Office of Academic Integrity” is the office responsible for managing all administrative functions relating to complaints and allegations of Honor Code violations including investigations, making recommendations to the Dean, coordinating College Committee hearings, and convening the College Committee.

An “academic program” is defined as any graduate or undergraduate course, independent study or research for academic credit, laboratory, internship, externship, clinical program, practicum, field placement, or other form of study or work offered in furtherance of the academic mission of the University. Academic work includes any work performed or assigned to be performed in connection with any academic program.

This Honor Code is intended to prohibit all forms of academic dishonesty and should be interpreted broadly to carry out that purpose. The following examples illustrate conduct that violates this Honor Code, but this list is not intended to be an exhaustive compilation of conduct prohibited by the Honor Code:

1. Giving or receiving unauthorized assistance, or attempting to give or receive such assistance, in connection with the performance of any academic work.
2. Unauthorized use of materials or information of any type or the unauthorized use of any electronic or mechanical device in connection with the completion of any academic work.
3. Access to the contents of any test or examination or the purchase, sale, or theft of any test or examination prior to its administration.
4. Use of another person’s work or ideas without proper acknowledgment of source.
5. Intentional misrepresentation by word or action of any situation of fact, or intentional omission of material fact, so as to mislead any person in connection with any academic
work (including, without limitation, the scheduling, completion, performance, or submission of any such work).

6. Offering or giving any favor or thing of value for the purpose of influencing improperly a grade or other evaluation of a student in an academic program.

7. Conduct intended to interfere with an instructor’s ability to evaluate accurately a student’s competency or performance in an academic program.

Whenever a student is uncertain as to whether conduct would violate this Honor Code, it is the responsibility of the student to seek clarification from the appropriate faculty member or instructor of record prior to engaging in such conduct.

Quoted from Carolina Community: This document is only published on the web http://www.housing.sc.edu/academicintegrity/honorcode.html.

FINANCIAL AID

Types of Support

Several forms of financial aid are available to graduate students. The Graduate School and the College of Engineering and Information Technology award fellowships and the Department awards a fellowship and assistantships (TA's and RA's). Students seeking student loans must make necessary arrangements with the Office of Financial Aid.

Teaching Assistantships

For the 2011-2012 academic year, the stipend for a Teaching Assistant in Computer Science and Engineering is $13,400, or $12,400, depending on the duties assigned. The assistantship also includes a reduction in the tuition fee to the in state rate and there traditionally been additional tuition supplements provided by the department that eliminate tuition costs for full time graduate assistants. The workload of a TA should be 20 hours per week. Duties include grading papers, holding office hours for student consultation, and lecturing in laboratories under a faculty member's direction. Typically TA's assist a faculty member in teaching a large section of an elementary course. After completion of 18 hours, TA's may be asked to teach a course independently.

Research Assistantships

A number of graduate students are supported as research assistants (RA's) by research grants and contracts. This may entail work that leads to their thesis research. Faculty members who currently have research grants/contracts choose research assistants.

A limited number of teaching and research assistantships are available during the summer. Application for these should be made early in the spring semester. First priority is given to current teaching assistants. Stipends and duties vary.

Industrial Research Assistants

Several local companies support research assistants to work off campus. Recent companies include State Agencies, J. D. Edwards, Coastal Sciences Corporation etc.
Fellowships
There are different sources of funds for fellowships. Some depend upon general University appropriations. Others are derived from endowed funds given to the University by donors. A list of available fellowships can be found in the Graduate Bulletin. The Department currently has the Rothberg fellowship in Bioinformatics that provides $25,000 in support.

Curricula Practical Training
International students on F-1 visas can only work off campus as part of curricula practical training, which is a one semester directed readings course that is augmented by a job off campus. This job serves to enhance the directed readings course by providing real world experience. Frequently students do this over the summer, but they are not allowed to extend the training beyond one semester or beyond one summer.

PhD and TA Progress Reports and Support Renewal Policy
Graduate assistantships are awarded on the basis of merit and are renewable annually, subject to a review of each student's progress. To insure that the students make good progress towards the completion of their degrees each student is required to fill out a progress report each semester during the advisement period. There is a copy of the template on the web at http://www.cse.sc.edu/~matthews/GRADUATE/Documents/ProgressReport.doc. In addition there are time limits beyond which assistantships will not be renewed regardless of performance. The limits are:
1. M.S. candidates will not be supported beyond two years of their entry into the program.
2. Ph.D. candidates will not be supported beyond five years of their entry into the Ph.D. program.
Research assistantships are not subject to the preceding limitations. Full-time graduate assistants are not allowed to undertake additional employment.

Payroll and Tax Information
I-9 Forms: Graduate assistants are required by the federal government to fill out an I-9 form to verify their employment eligibility. This form may be obtained from the Graduate Secretary and must be turned in to the Graduate Director within three days of the start of employment. Filling it out requires proof of identity and of employment eligibility. Usually some combination of passport or driver's license and social security card is used in filling out the form. Delay in filling out the I-9 will delay the student’s initial paycheck.

Payroll: The graduate assistantship is an academic year (9 month) appointment. Summer assistantships are administered separately. Paychecks are issued bi-weekly on the last business day on or before the 15th and the last business day of the month. The first check arrives at the end of August, the last check in mid-May. One summer check is issued at the end of summer session I. For summer session II, two checks are issued; one at midterm (end of July), and one at the end of the session.

Taxes and Withholding: Each assistant should complete a W-2 form, available in the Graduate Director's office. If no W-2 is submitted to payroll, the default is 0 exemptions, resulting in a substantial amount of withholding. A method for determining the number of exemptions to claim and a form for calculating such exemptions is available from the local office of the IRS. The IRS normally considers income from a graduate assistantship taxable.
ADDITIONAL FACILITIES

Seminar/Colloquia
The department periodically arranges colloquium talks to be presented by distinguished visitors. Colloquia provide a valuable addition to the academic program and are an integral part of graduate study. Graduate students are encouraged and all graduate assistants are required to attend departmental seminars/colloquia. Colloquium talks are also given as a part of faculty applicant interviews. The search committee encourages graduate student opinion on faculty applicants.

Seminars, informally organized around specific topics of interest, are conducted periodically by our faculty and graduate students of advanced standing. Attendance at these seminars definitely helps to broaden one's views.

Use of Departmental Facilities
Laboratory Use: Smoking, eating, and drinking in laboratories, equipment rooms, and terminal rooms are prohibited. Smoking is prohibited in all University buildings.

Students with laboratory access are expected to take their trust very seriously. They will not loan their key to any other person nor give out the combination of any lock to any other person. Those who breach security will be dealt with appropriately.

Graduate students have the same access to public terminal rooms and remote computing facilities as do undergraduates. In addition, they may obtain a key from the Office Manager, which will allow them after hours entry to Swearingen. Keys are not transferable.

Use of Telephones: Teaching, research, and staff assistants have telephones in assigned offices for local calls only.

COURSES

CSCE 798: Directed Reading and Research
Graduate students may register in this course for varying number of credits. The number of credits in any one semester must not exceed three and the cumulative total number that can be applied towards the degree cannot exceed six. The purpose of this course is to provide opportunities for advanced graduate students to pursue intensive reading in a highly specialized area.

A graduate faculty member must supervise CSCE 798. Students are required to obtain the Graduate Director's approval before registering in this course. There should be no significant overlap between the contents of a CSCE 798 course and other courses that are offered by the
department. An approval form must be signed by both the student and the faculty member supervising the course before submitting it to the Graduate Director.

**CSCE 799: Thesis Preparation**

After completing at least 15 credits of course work and submitting the Thesis Advisor form, an M.S. student may register for CSCE 799 with the approval of his/her thesis advisor. Students pursuing the Research option are encouraged to register for Thesis Preparation in two separate semesters. In addition, students must be enrolled during the semester in which they turn in the final copies of their thesis/dissertation to the Graduate School.

**CSCE 899: Dissertation Preparation**

Ph.D. students must complete a Thesis Advisor form to select a Dissertation Advisor. A Ph.D. student may then register for Dissertation Preparation with the approval of his/her Dissertation Advisor. In addition, Ph.D. students must be enrolled in 899 during any semester in which they are actively consulting with a faculty member or using university facilities. In particular they must be registered during the semester in which they turn in the final copies of their dissertation to the Graduate School.

**Course Descriptions URL from**
[http://www.sc.edu/bulletin/grad/GCompSci.html](http://www.sc.edu/bulletin/grad/GCompSci.html)

**Course Descriptions (CSCE)**

- **500 -- Computer Programming and Applications. (3)** Concepts and properties of algorithms; programming exercises with emphasis on good programming habits. Credit may not be received for both CSCE 500 and CSCE 145. Open to all majors. May not be used for major credit by computer science and engineering majors.
- **510 -- System Programming. (3)** (Prereq: CSCE 245) System software such as command language interpreters, client-server applications, debuggers; mail systems, browsers, macroprocessors, and revision control systems; file systems, processes, threads, and interprocess communication.
- **512 -- System Performance Evaluation. (3)** (Prereq: CSCE 311, STAT 509) Measuring, modeling, analyzing, and predicting performance of computer systems and networks; bottleneck analysis; Markovian queuing systems and networks; use of operational and probabilistic models.
- **513 -- Computer Architecture. (3)** (Prereq: CSCE 211, 212) Design methodology; processor design; computer arithmetic: algorithms for addition, multiplication, floating point arithmetic; microprogrammed control; memory organization; introduction to parallel architectures.
- **515 -- Computer Network Programming. (3)** (Prereq: CSCE 311) Computer networks and communication protocols; socket programming; interprocess communication; development of network software; case studies.
• **516 -- Computer Networks. (3)** (Prereq: STAT 509) Structure, design, and analysis of computer networks; ISO/OSI network architecture.

• **517 -- Computer Crime and Forensics. (3)** (Prereq: CSCE 311) Methodical approaches for collecting and preserving evidence of computer crimes. Foundational concepts such as file system structures, MAC times, and network protocols; tools for extracting evidence; general legal issues.

• **520 -- Database System Design. (3)** (Prereq: CSCE 245 or GEOG 563) Database management systems; database design and implementation; security, integrity, and privacy.

• **522 -- Information Security Principles. (3)** (Prereq: CSCE 520 or MGSC 596) Threats to information resources and appropriate countermeasures. Cryptography, identification and authentication, access control models and mechanisms, multilevel database security, steganography, Internet security, and intrusion detection and prevention.

• **526 -- Service Oriented Computing. (3)** (Prereq: CSCE 311) Cooperative information systems and service-oriented computing. Techniques for achieving coordinated behavior among a decentralized group of information system components. Distributed databases, multiagent systems, conceptual modeling, Web services, and applications.

• **531 -- Compiler Construction. (3)** (Prereq: CSCE 330 or 355, CSCE 245) Techniques for design and implementation of compilers, including lexical analysis, parsing, syntax-directed translation, and symbol table management.

• **547 -- Windows Programming. (3)** (Prereq: CSCE 245) Object-oriented methods and tools for application programming with graphically interactive operating systems.

• **548 -- Building Secure Software. (3)** (Prereq: CSCE 510 or consent of instructor) Construction of software systems resistant to vulnerabilities and attacks. Cryptographic tools. Language, operating systems, and network security. Case studies. Development of best practices through programming assignments.

• **551 -- Theory of Computation. {=MATH 562} (3)** (Prereq: CSCE 350 or MATH 526 or 544 or 574) Basic theoretical principles of computing as modeled by formal languages and automata; computability and computational complexity. Major credit may not be received for both CSCE 355 and CSCE 551.

• **552 -- Computer Game Design and Programming. (3)** (Prereq: C or better in CSCE 240, 245 and 350) Students will learn technologies and concepts involved in game design and programming. Students will also learn art and design principles for game developing human computer interaction, graphic design, music.

• **555 -- Algorithms in Bioinformatics. (3)** (Prereq: CSCE 350) Concepts, algorithms and tools for important problems in Bioinformatics, including nucleotide and amino acid sequence alignment, DNA fragment assembly, phylogenetic reconstruction, and protein structure visualization and assessment.

• **557 -- Introduction to Cryptography. {=MATH 587} (3)** (Prereq: CSCE 145, MATH 241, and either CSCE 355 or MATH 574) Design of secret codes for secure communication, including encryption and integrity verification: ciphers, cryptographic hashing, and public key cryptosystems such as RSA. Mathemtical principles underlying encryption. Code-breaking techniques. Cryptographic protocols.

• **561 -- Numerical Analysis. {=MATH 527} (3)** (Prereq: MATH 242 or 520) Interpolation and approximation of functions; solution of algebraic equations; numerical differentiation and integration; numerical solutions of ordinary differential equations and boundary value problems; computer implementation of algorithms.
• **563 -- Systems Simulation. (3)** (Prereq: CSCE 245, STAT 509) Computer simulation of real systems; principles of system organization; random number generation; programming exercises in a simulation language.

• **564 -- Computational Science. (3)** (Prereq: MATH 526, CSCE 146 or 207 or 500) Parallel algorithms; scientific visualization; techniques for solving scientific problems.

• **565 -- Introduction to Computer Graphics. (3)** (Prereq: CSCE 245, MATH 526) Graphics hardware; graphics primitives; two-dimensional and three-dimensional viewing; basic modeling.

• **567 -- Visualization Tools. (3)** (Prereq: CSCE 145 or 206 or 207) Scientific visualization tools as applied to sampled and generated data; methods for data manipulation and representation; investigation of visualization techniques.

• **569 -- Parallel Computing. (3)** (Prereq: knowledge of programming in a high-level language; MATH 526 or 544) Architecture and interconnection of parallel computers; parallel programming models and applications; issues in high-performance computing; programming of parallel computers.

• **574 -- Robotics. (3)** (Prereq: CSCE 211, 212, and 245) Design and application of robotic systems; emphasis on mobile robots and intelligent machines.

• **578 -- Text Processing. (3)** (Prereq: CSCE 330, 355) Text and natural language processing; formal models and data structures appropriate for text processing; selected topics in computational linguistics, stylistics, and content analysis.

• **580 -- Artificial Intelligence. (3)** (Prereq: CSCE 350) Heuristic problem solving, theorem proving, and knowledge representation, including the use of appropriate programming languages and tools.

• **582 -- Bayesian Networks and Desicion Graphs. =STAT 582 (3)** (Prereq: CSCE 350 and STAT 509) Normative approaches to uncertainty in artificial intelligence. Probabilistic and causal modeling with Bayesian networks and influence diagrams. Applications in decision analysis and support. Algorithms for probability update in graphical models.

• **590 -- Topics in Information Technology. (3)** Reading and research on selected topics in information technology. Course content varies and will be announced in the schedule of courses by suffix and title. May be repeated for credit as topics vary.

• **611 -- Conceptual Modeling Tools for CAD. (3)** (Prereq: CSCE 211, 245) Design techniques for logic systems; emphasis on higher-level CAD tools such as hardware description languages and conceptual modeling.

• **612 -- VLSI System Design. (3)** (Prereq: CSCE 211, 245) VLSI design process models, introduction to EDA tools, HDL modeling and simulation, logic synthesis and simulation, benchmark design projects.

• **613 -- Fundamentals of VLSI Chip Design. (3)** (Prereq: ELEC 371) Design of VLSI circuits, including standard processes, circuit design, layout, and CAD tools. Lecture and guided design projects.

• **711 -- Advanced Operating Systems. (3)** (Prereq: CSCE 311) Operating system organization and interactive processing systems, multiprogramming systems, process management, task scheduling, resource control, deadlocks.

• **713 -- Advanced Computer Architecture. (3)** (Prereq: CSCE 311 and 513) Architecture of high-performance computers, including array processors, multiprocessor systems, data flow computers, and distributed processing systems.

• **716 -- Design for Reliability. (3)** (Prereq: STAT 509 or 511, or MATH 511) Design of more reliable systems through the application of reliability theory and models; reliability modeling; design techniques; testing; and requirement specifications.

• **717 -- Computer System Performance and Reliability Analysis. (3)** (Prereq: STAT 509 or 511) Evaluation of computer system performance and reliability using reliability block diagrams, fault trees, reliability graphics, queuing networks, Markov models, and Markov reward models.

• **718 -- Real-Time Computer Applications. (3)** (Prereq: CSCE 245, 311) Problems of real-time computer applications in process control or similar areas; task scheduling; real-time operating systems; advanced interrupt structures; memory management techniques.

• **721 -- Physical Database Design. (3)** (Prereq: CSCE 520) Components of a database management system; implementation issues; query optimization; file organization; file organizations' transaction management; fault recovery; security; system performance.

• **723 -- Advanced Database Design. (3)** (Prereq: CSCE 520) Database design methodologies and tools; data models; implementation languages; user interfaces.

• **725 -- Information Retrieval: Algorithms and Models. (3)** Structure, design, evaluation, and use of information retrieval systems; algorithms and mathematical models for information retrieval; storage and retrieval of textual data in information systems.

• **727 -- Information Warfare. (3)** (Prereq: CSCE 522) Current trends and challenges in information warfare. High-level analysis of information warfare threats, like cyber terrorism, espionage, Internet fraud, intelligence activities, cyber ethics, and law enforcement.

• **730 -- Programming Language Semantics. (3)** (Prereq: CSCE 531) Approaches for specifying programming language semantics, including operational, axiomatic, and denotational specification.

• **740 -- Software Engineering. (3)** (Prereq: CSCE 240) Current practices and research in software development, requirements definition, design, program testing and reliability, maintenance, and management.

• **741 -- Software Process. (3)** Personal, team, and organizational software processes; personal and organizational maturity; application of software process and management concepts during software development, primarily at the individual level. Not auditable.

• **742 -- Software Architectures. (3)** Structural organizations for software systems as collections of interconnected components: formal models and languages; design tools and guidelines. Not auditable.

• **743 -- Software Requirements. (3)** (Prereq/coreq: CSCE 740) Elicitation, analysis, and validation of software requirements, specification of software systems including formal specification methods; CASE tools. Not auditable.

• **744 -- Object-Oriented Analysis and Design. (3)** (Prereq: CSCE 350) Fundamentals of object-oriented technology; object modeling of structure, function, and time-dependent behavior; system analysis and design.
• 745 -- Object-Oriented Programming Methods. (3) (Prereq: CSCE 245) Object-oriented programming paradigm, including encapsulation, inheritance, reusable classes, object classification, specialization, and message passing; case studies and applications.

• 747 -- Software Testing and Quality Assurance. (3) (Prereq: CSCE 740) Structural and functional techniques for testing software; code inspection, peer review, test verification and validation; statistical testing methods; preventing and detecting errors; testing metrics; test plans; formal methods of testing. Not auditable.

• 750 -- Analysis of Algorithms. (3) (Prereq: CSCE 350) Algorithm design techniques; algorithms and data structures for sets and graphs; time and space complexity; sorting and searching; NP-complete problems.

• 755 -- Computability, Automata, and Formal Languages. (3) (Prereq: CSCE 355 or 551) Formal models of computation, including finite state automata, Turing machines, recursive functions, formal grammars, and abstract complexity theory.

• 758 -- Probabilistic System Analysis. (3) (Prereq: STAT 509 or 511) Application of probability theory and stochastic processes to analyze the dynamic behavior of engineering systems.

• 760 -- Numerical Analysis I. (3) (Prereq: MATH 526 or 544) Numerical solution of equations and systems of linear equations, polynomial approximation, difference calculus, solution of ordinary and partial differential equations, least squares and sets of orthogonal polynomials, Gaussian quadrature.

• 761 -- Numerical Analysis II. (=MATH 727) (3) (Prereq: CSCE 760) Continuation of CSCE 760.

• 763 -- Digital Image Processing. (3) Concepts and techniques for digital image processing; emphasis on low-level processes that analyze discrete images at the pixel level.


• 766 -- Scientific Visualization. (3) (Prereq: CSCE 565) Visualization techniques for scientific computing; interactive steering of calculations; animation and rendering techniques for multivariate data analysis.

• 767 -- Interactive Computer Systems. (3) Principles for the design of systems supporting effective human-computer interaction; interaction styles; displays and interactive devices; user assistance; system design and evaluation.

• 768 -- Pattern Recognition and Classification. (3) (Prereq: STAT 509 or 510 or 511) Bayesian classifiers; optimal risk schemes; error rates; numerical methods; implementation; architectures.

• 769 -- Computational Structural Biology. (3) (Prereq: consent of instructor) Theoretical concepts and algorithmic tools currently utilized in the field of protein folding such as Xplor-NIH and ROSETTA are presented. Participants are enabled to embark in research of protein folding.

• 771 -- Computer Processing of Natural Language. (3) (Prereq: CSCE 580) Computational models for the analysis and synthesis of natural language; representations for syntax and semantics; applications to text-to-speech conversion, speech recognition, and language understanding.
• **772 -- Computer Speech Processing. (3)** (Prereq: CSCE 580) A/D conversion, digital filters, discrete Fourier transform and FFT, acoustics of speech, and synthesis and recognition of speech.

• **774 -- Robotics Systems. (3)** (Prereq: CSCE 574) Design and operation of robot systems; dynamics, control, and motion trajectories of manipulators; visual, auditory, and tactile sensing systems; planning and learning.

• **780 -- Knowledge Representation. (3)** (Prereq: CSCE 580) Representation techniques and languages for symbolic knowledge, including predicate calculus, frame-based systems, and terminological systems; computer reasoning using these systems.

• **781 -- Knowledge Systems. (3)** (Prereq: CSCE 580) Expert system domains, knowledge representation techniques, inference engines, and knowledge acquisition methods.

• **782 -- Multiagent systems. (3)** (Prereq: CSCE 580) Coordinated problem solving by multiple knowledge systems.

• **784 -- Neural Information Processing. (3)** (Prereq: MATH 526 or 544) Mathematical foundations of biological and artificial neural networks, supervised and unsupervised systems, applications.

• **787 -- Introduction to Fuzzy Logic. (3)** (Prereq: MATH 174) Principles of fuzzy set theory, fuzzy relations, and fuzzy logic; fuzzy "if-then" rules.

• **790 -- Topics in Information Technology. (1-3)** Reading and research on selected topics in information technology. Course content varies and will be announced in the schedule of courses by suffix and title. May be repeated for credit as topics vary.

• **791 -- Seminar in Computer Science Research. (1)** Major computing research areas technical writing and presentations; ethics in research and writing; support tools, including text formatting systems, text analysis tools, and software development tools.


• **797 -- Individual Study and Research. (1-12)** Individual research to be arranged with the instructor. Pass/Fail grading.

• **798 -- Directed Study and Research. (1-12)** Individual research to be arranged with the instructor.

• **799 -- Thesis Preparation. (1-12)**

• **813 -- Internet Security. (3)** (Prereq: CSCE 522 and CSCE 715) Study security threats and prevention/detection/response techniques on the Internet, including hackers, masqueraders, information spoofing, sniffing, and distribution of damaging software. Security analysis of Web applications.

• **814 -- Distributed Systems Security. (3)** (Prereq: CSCE 522) Security mechanisms of distributed software systems, including cryptographic applications. Secure multiparty computation, group-based cryptography, and security mechanisms for emerging distributed architectures.

• **815 -- Computer Communications. (3)** (Prereq: CSCE 515 or 516) Contemporary computer communication protocols and network architectures.

• **818 -- Top-Down VLSI Design. (3)** (Prereq: CSCE 611 or CSCE 612) VLSI system design automation, hardware description language-based design, multi-methodology design, and introduction to HDL support tools.
• **819 -- Custom VLSI Design.** (3) (Prereq: CSCE 611 or 612) Custom design methodology, design rules, stick notation, logic synthesis, and circuit layout; symbolic layout languages; introduction to CAD tools.

• **821 -- Distributed Database Design.** (3) (Prereq: CSCE 520) Architecture, design, and implementation of distributed database management systems; data fragmentation, replication, and allocation; query processing and transaction management; distributed object database management systems.

• **822 -- Data Mining and Warehousing.** (3) (Prereq: CSCE 520) Information processing techniques and mathematical tools to assemble, access, and analyze data for decision support and knowledge discovery.


• **826 -- Cooperative Information Systems.** (3) (Prereq: CSCE 520, 580) Strategies for achieving coordinated behavior among a heterogeneous group of information system components; world-wide information networks and applications in health care, logistics, telecommunications, and manufacturing automation.

• **846 -- Software Reliability and Safety.** (3) (Prereq: STAT 509 or 510 or 511) Reliability and safety of computer-intensive systems; software reliability models and analysis; operational profiles; hazard analysis using fault trees and event trees; formal verification of safety-critical systems. Not auditable.

• **850 -- Advanced Analysis of Algorithms.** (3) (Prereq: CSCE 750) Definitions of algorithms and formal models of computation; concepts of space and time; synthesis and analysis of algorithms for sorting, search graphs, set manipulation and pattern matching; NP-complete, and intractable problem.

• **853 -- Formal Methods in Computer Security.** (3) (Prereq: CSCE 522 and 715) Formal techniques applied to computer security, including formal specification language for security properties, security analysis utilities, domain-specific security concerns, and case studies of formally verified secure systems.

• **865 -- Advanced Computer Graphics.** (3) (Prereq: CSCE 765) Input and display devices, data structures, architectures, primitives, and geometrical transformations appropriate to computer graphics, parametric surfaces.

• **867 -- Computer Vision.** (3) (Prereq: CSCE 763) Scene segmentation using texture, color, motion; representation of 2-D or 3-D structures; knowledge-based vision systems.

• **868 -- Advanced Pattern Recognition.** (3) (Prereq: CSCE 768) Feature nomination, selection, extraction, and evaluation; deterministic, stochastic, and fuzzy models for classifier design; parameter estimation; error rate estimation; clustering and sequential learning.

• **883 -- Machine Learning.** (3) (Prereq: CSCE 580) Fundamentals of machine learning including rote learning, learning from examples, learning from observations, and learning by analogy; knowledge acquisition for expert systems.

• **895 -- Ph.D. Seminar.** (1-3)

• **899 -- Dissertation Preparation.** (1-12)
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