SCHOOL OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Graduate Program Policies and Procedures 2007-2008

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CHAPTER 1

EECS GRADUATE PROGRAM REGULATIONS

Master of Science

The degree of Master of Science is awarded to graduate students for demonstration of substantial scholarly achievement beyond the baccalaureate level. This achievement represents more than the mere accumulation of additional credit as the student is expected to demonstrate an integrated knowledge of the chosen discipline. The School of EECS offers MS programs in Electrical Engineering, Computer Science and Computer Engineering (thesis and non-thesis options). The regulations below apply to the EE, CS and CE masters programs unless otherwise noted.

1.1 Admission

The School evaluates applicants for admission to the MS program based on college transcripts, GPA, the score on the general GRE, letters of recommendation, a statement of purpose, and TOEFL score, if applicable. All the materials except the statement of purpose should be sent to the Graduate School at P. O. Box 641030, Pullman, WA 99164-1030 or if you use express mail such as FedEx or DHL, send them to the Graduate School, French Administration Building, Room 324, Pullman, WA 99164-1030. Additional materials such as publications or research activity may be submitted to the department via e-mail attachments, if desired. The Graduate Studies Committee will consider these materials and students judged most qualified will be offered admission. (Admission does not guarantee assistantship support.)

Specific Admission Requirements in Computer Science for students with non-BS/CS major:

Students whose undergraduate studies did not include material equivalent to that covered in the following WSU courses will be asked to take course work to resolve that undergraduate deficiency: **Cpt S 121, 122, 223, 260, 317, 355, 360, 450; Phil 201 and Math 216**. *All of these courses should be completed before the student is eligible for admission to the MS or PhD Program in Computer Science.* The admissions committee may require the student to correct other undergraduate deficiencies as well, including undergraduate prerequisite courses to graduate courses.

Specific Admission Requirements in Electrical Engineering for students with non-BS/EE major:

Students whose undergraduate studies did not include material equivalent to that covered in the following WSU courses will be asked to take course work to resolve that undergraduate deficiency: **EE 214, 261, 311, 234, 321, 331, 352, 489 and any two of 341, 351, 361 or CptS 360**. *All or most of these courses should be completed before the student is eligible for admission to the MS or Ph.D. Program in EE.* In addition, the committee may require the student to complete other undergraduate deficiencies including courses that are prerequisite to graduate courses.

Specific Admission Requirements in Computer Engineering for students with non-BS/CE major:

Students whose undergraduate studies did not include material equivalent to that covered in the following WSU courses will be asked to take course work to resolve that undergraduate deficiency**: CptS 121, 122, and 360; EE 214, 234, 324, and 334; Math 216**. *All or most of these courses should be completed before the student is eligible for admission to the MS Program in CE.* In addition, the committee may require the student to complete other undergraduate deficiencies including courses that are prerequisite to graduate courses.

1.2 Registration Requirements

Each graduate student receiving financial support from the School of Electrical Engineering and Computer Science in the form of teaching or research assistantship or fellowship must register for 16 credit hours each semester. At least nine of these credits should be graded courses, unless the student is near the end of the program and the course work is near completion. The remainder of the credits may be made up of research credits, i.e., EE or Cpt S 700.

Full-time students who are self-supporting should register for at least 10 credit hours each semester, but may choose to register for more.

Students considering dropping or withdrawing from a course that will put them below the requirements listed above should have the approval of their advisor and/or the Graduate Coordinator.

1.3 Thesis Option

1.3.1 Program of Study and Advisory Committee

Computer Science:

The program must consists of 33 or more hours of credit including 24 or more hours of coursework for which a grade of A-F is given and 9 or more credits of thesis research (EE or Cpt S 700).

Computer Engineering:
The program must consists of 30 or more hours of credit including 21 or more hours of coursework for which a grade of A-F is given and nine or more credits of thesis research (EE 700).

Electrical Engineering:
The program must consist of 30 or more hours of credit including 21 or more hours of coursework for which a grade of A-F is given and nine or more credits of thesis research (EE 700).

Under the thesis option (all programs), the student is expected to complete a significant research project and submit a thesis, which adheres to EECS standards and the formatting requirements of the advisory committee and the Graduate School. The thesis work should be submitted for refereed publication prior to scheduling the final exam. It is the student's responsibility to meet the deadlines specified by the Graduate School and to have the thesis printed, photocopied, and distributed. One bound copy of the thesis must be provided to the School of Electrical Engineering and Computer Science as part of its thesis and dissertation library. All students on financial aid from WSU must choose the thesis option.

Before a **thesis** student has earned fifteen credits toward a graduate degree, an advisory committee of at least three faculty members shall be nominated with the mutual consent of the student, the director of the School of EECS (or the director's designee) and each prospective committee member. The major advisor (also Chair of the advisory committee) and another committee member must be members of EECS Permanent (i.e. Non-Adjunct) Graduate Faculty. The Chair of the advisory committee must be a specialist in the student's intended area of research and the supervisor of the research. It is the responsibility of the student to find a major advisor (committee chair) and work with him or her to nominate additional members in accordance with the timetable in Section 1.8. As soon as the committee is nominated, members should assist the student in identifying a research topic and selecting a set of courses (the program) that meet EECS and Graduate School requirements and is consistent with the research objectives of the student.

The program for the MS degree specifies the courses that the student **must** complete. The program of study, signed by members of the advisory committee and the director (or designee), is submitted for approval to the Graduate School on the form "Program for Master's Degree." Committee appointments and the MS program are not official until approved by the Graduate School. Changes in the student's program can be made with the approval of the student, the advisory committee, the director (or designee) and the Graduate School. The advisory committee

membership can be changed with the approval of the student, the school director, the Graduate School, and the persons who would constitute the new committee.

A maximum of six credits of 400 level course work **approved** by the GSC may be included on a Master's program (Note: The MS/CS Thesis Option allows only up to 3 credits of 400 level approved course work). Only one 3-credit Directed Study (EE or Cpt S 595) may be included. The student may take courses on a P/F basis, but these courses cannot be used in the student's official degree program. Students on appointment must have such P/F courses approved by the GSC chair. The Graduate School specifies the minimum allowable grade-point average (GPA) for students in graduate programs. Students not maintaining a 3.0 GPA run the risk of academic probation and dismissal from the program.

A maximum of six graduate-level transfer credits is allowed. Students may petition the Graduate Studies Committee (GSC) to include transfer credits, but only if equivalent courses are offered at the graduate level, are completed in a recognized graduate school as a graduate student, and are clearly consistent with the objectives of the student's program at WSU. Refer to Section 1.5 for the procedures to request graduate level transfer credits.

1.3.2 Specific Program Requirements

1.3.2.1 M.S. Computer Science Degree Program: Thesis Option

In order to ensure that each student obtains a reasonable graduate level understanding of a number of fundamental areas, each MSCS student (Thesis Option) must complete the following course requirements.

Required for all Pullman campus students their first fall in residence:

- Cpt S 500, Proseminar

At least one of:

- Cpt S 515, Advanced Algorithms
- Cpt S 516, Automata Theory

At least one of:

- Cpt S 550, Parallel Computation
- Cpt S 555, Computer Communication Networks
- Cpt S 560, Operating Systems
- Cpt S 561, Computer Architecture
- Cpt S 564, Distributed Systems

And at least one of:

- Cpt S 521, Software Engineering Analysis
- Cpt S 527, Computer Security

- Cpt S 542, Computer Graphics
- Cpt S 541, Artificial Intelligence
- Cpt S 543, Human Computer Interaction
- Cpt S 551, Database Systems
- Cpt S 580, Computational Genomics

Only one 3-credit Directed Study (CptS or EE 595) may be included. One 400- level course is allowed. The course is to be chosen in consultation with the advisor. However, CptS 401 and 402 cannot be used on the program nor can conjoint courses (those listed 400/500). That is, students must take the 500 level course if they wish to use it on a program.

Note: Students must have a BS degree in Computer Science or have completed the equivalent of the following WSU courses: Cpt S 121, 122, 223, 260, 317, 355, 360, 450; Phil 201 and Math 216 before admission to the MS program in Computer Science.

1.3.2.2 M.S. Electrical Engineering Degree Program: Thesis Option

In order to ensure that each student obtains a reasonable graduate level understanding of a number of fundamental areas, each MSEE student must successfully complete at least three of the following eight courses:

- EE 501 Linear Systems Theory
- EE 503 Structure, Dynamics and Control of Large-Scale Networks **OR**
- EE 555 Computer Communication Networks
- EE 507 Random Processes in Engineering
- EE 518 Advanced Electromagnetic Theory
- EE 521 Power Systems Analysis
- EE 524 Digital Systems Architecture
- EE 596 Advanced Analog Integrated Circuits
- CptS 516 Automata Theory

Note: Only one course from EE 503 and EE 555 can be counted as one of the three required core courses.

Only one 3-credit Directed Study (EE 595) may be included. A maximum of 6 credits of 400 level course work approved by the GSC may be included. In general, undergraduate courses REQUIRED for the BS/EE and undergraduate courses listed as pre-requisite for admission into the MS/PhD in EE program will NOT BE allowed.

Note: Students must have a BS degree in Electrical Engineering or have completed the equivalent of the following WSU courses: EE 214, 234, 261, 311, 321, 331, 352, 489 and any two of the 341, 351, 361, or Cpt S 360 before admission to the MS program in Electrical Engineering.

1.3.2.3. MS Computer Engineering Degree Program: Thesis Option

In order to ensure that each student obtains a reasonable graduate level understanding of a number of fundamental areas, an MS Cpt E student must successfully complete at least three of the following seven courses:

- EE 530 Digital Signal Processing
- EE 554 Asynchronous Digital Systems
- EE 586 VLSI Systems Design
- EE 524/Cpt S 561 Advanced Computer Architecture
- CptS/EE 555 Computer Communication Networks or EE 503 Structure, Dynamics and Control of Large-Scale Networks
- Cpt S 560 Operating Systems
- EE 587 System on Chip Design and Test

Only one 3-credit Directed Study (EE or Cpt S 595) may be included. A maximum of 6 credits of 400 level course work approved by the GSC may be included. In general, undergraduate courses REQUIRED for the BS/CE and undergraduate courses listed as pre-requisite for admission into the MS in CE program will NOT BE allowed.

Note: Students must have a BS degree in Computer Engineering or have completed the equivalent of the following WSU courses: Cpt S 121, Cpt S 122, Cpt S 360, EE 214, EE 234, EE 324, EE 334, and Math 216.

1.3.3 Thesis Option Final Examination

The student must file an "Application for Degree" form with the Graduate School on or before the deadline date specified by the Graduate School.

The final examination should be scheduled after the student has completed course work, applied for the degree, and had the thesis approved by the advisory committee. Along with the scheduling form for the M.S Thesis Final Exam, a List of Publications (submitted, accepted, or in preparation) should be submitted to the GSC. The publication list should include (anticipated) date of submission (or appearance) and the full name of the conference or journal. **Note**: At least one paper must have been submitted for publication before the scheduling form will be signed. The examination will be administered by the advisory committee and will cover the thesis

defense and the area of knowledge covered by the student's program of study. The advisory committee members must vote on passage or failure and any other member of the graduate faculty may elect to do so. In the event of a failed examination, a second and final attempt may be scheduled at the request of the School after a lapse of at least three months.

1.4 Non-Thesis Option

1.4.1 Non-Thesis Option in Electrical Engineering

Under the non-thesis option, the student is required to take at least 28 credits of graduate level course work (non P/F and non S/F) plus two credits of EE 702. Of the 30 credits of course work, at least 18 must be in Electrical Engineering and must satisfy the program requirements as stated in Section 1.3.2. A maximum of 6 credits of 400 level course work approved by the GSC may be included. Only one 3-credit Directed Study (EE 595) may be included. The student is required to follow the procedures described above for the thesis student and form an advisory committee to assist them in designing a program for this option. In particular, the student's advisor must approve the student's course program. The student following the course option must take a comprehensive examination in one of the following areas after the completion of the course work.

1) Computer Engineering
2) Electrophysics (Electromagnetics, Waves, Solid State)
3) Energy and Power Systems
4) Microelectronics
5) Systems (Communications, Controls and Signal Processing)

The student must show proficiency in the chosen area and pass the exam. Students may take the MS comprehensive exam only twice. A failure to pass the examination for the second time will result in a recommendation for dismissal from the graduate program.

Non-thesis Project Option: (Available at Tri-Cities Campus only). The project option shall consist of at least 27 graded credits and six credits of EE 702. Of the 27 credits of course work, at least 15 must be in electrical engineering and must satisfy the program requirements as stated in Section 1.3.2. Specific course requirements are the same as for other EE non-thesis programs. Students are required to complete a project and submit a report on the project which is satisfactory to the advisory committee. The project should represent work equivalent to two three-credit hour graduate courses and the quality equivalent to a grade of "B" or better.

Note: Students must have a BS degree in Electrical Engineering or have completed the equivalent of the following WSU courses: EE 214, 234, 261, 311, 321, 331, 352, 489 and any two of the 341, 351, 361, or Cpt S 360 before admission to the MS program in Electrical Engineering.

1.4.1.1. Guidelines for non-thesis examination by area:

1. Computer Engineering: Students who enroll in the non-thesis (coursework only) Master's degree in Computer Engineering will be required to pass a final, comprehensive defense of their graduate program. Three faculty members, of whom two will be in the computer and software engineering area and the third will be from the general faculty of the School of EECS, will administer this exam. The candidate must submit an examination committee request to the graduate secretary, listing at least two examination committee members selected from the graduate faculty of the School. The School will appoint the final member of the examination committee.

The examination/defense committee will select material to evaluate the candidate. The evaluation will consist of the following three components:

(a) A design problem
(b) A written report on a subject within the field
(c) An oral examination

The candidate will be given specific, written instructions on each of these components of the exam.

A design problem will be given to the candidate on Monday morning, with a design report (10-15 pages) due Wednesday morning. The design problem is intended to test the candidate's ability to integrate and constructively use knowledge acquired in the core courses. This design problem will be based on the particular courses and interests in the candidate's background. For example, a design problem might be directed towards a finite state machine system, a microprocessor application, or an integrated circuit logic and electronics problem.

A subject/topic will be given to the candidate Wednesday morning, with a summary report (10-15 pages) due Friday morning. The subject is intended to test the candidate's ability to comprehend and integrate new material related to their field. It will consist of studying a particular subject, finding appropriate references on it, and providing a written review.

The oral examination will be given during the next week, and will consist of two parts, (1) 15-minute presentation by the candidate outlining the design-problem solution, followed by questions from the examination committee; and (2) question-and-answer session on the written report (approx 1 hour total).

2. Electrophysics: During the second semester of study, each non-thesis student will be assigned a three-person committee. The committee will hold an oral exam near the end of the semester in which the student will complete the required number of credits for the degree. One week prior to the oral exam, the student will be supplied with ten written questions: four from EE 518, one each from EE 431, EE 432, EE 504, EE 417/517, EE

526 and EE 574. The student will not supply written answers to these questions. Instead, questioning in the oral exam will be based on, but not limited to, these questions as deemed appropriate given the student's coursework. A student will be passed if the committee unanimously agrees that the student has sufficient understanding of electrophysics to meet a Master's degree.

3. Energy and Power: The power systems area comprehensive M.S. exam will be an oral exam with the format and passing requirement determined by the student's committee. The student will be expected to make an oral presentation of material selected by the committee.

4. Microelectronics: To be announced.

5. Systems: The systems area comprehensive M.S. exam will be identical to the systems Ph.D. qualifying exam, with the following exceptions: (1) there will be no breadth category, and (2) the passing threshold will be 60%. The exam committee reserves the option to reset the passing threshold, depending on the difficulty of a particular exam. Students who fail the systems area comprehensive M.S. exam on the first try will be allowed to retake the exam the next time it is offered. Students who fail the exam on their second attempt will not be allowed to take the systems area exam again.

1.4.2. Non-Thesis Option in Computer Science

Under the non-thesis option, the student is required to take at least **30** graded credits (Non P/F and non S/F) of graduate level course work plus two credits of CptS 702. Of the 30 credits of course work, at least 12 credits must be from graduate level Computer Science courses as follows:

At least one of :

- Cpt S 515 Advanced Algorithms
- Cpt S 516 Automata Theory

At least one of:

- Cpt S 550 Parallel Computation
- Cpt S 555 Computer Communication Networks
- Cpt S 560 Operating Systems
- Cpt S 561 Computer Architecture
- Cpt S 564 Distributed Systems

And at least two of:

- Cpt S 521 Software Engineering Analysis
- Cpt S 527 Computer Security

- Cpt S 541 Artificial Intelligence
- Cpt S 542 Computer Graphics
- Cpt S 543 Human Computer Interaction
- Cpt S 551 Database Systems
- Cpt S 580 Computational Genomics

Only one 3-credit Directed Study (CptS or EE 595) may be included. A maximum of 6 credits of 400 level course work approved by the GSC may be included. In general, undergraduate courses REQUIRED for the BS/CS or BA/CS and undergraduate courses listed as pre-requisite for admission into the MS/PhD in CS program will NOT BE allowed. Students should obtain approval of the advisory committee and the GSC *before* taking non-CptS courses. The student should consult with their graduate advisor regarding the choice of an emphasis area, and plan to take appropriate courses in this area.

Students following the course option must take a one-hour written exams in each of the following three areas after the completion of the course work.

1) Theory
2) Systems
3) Application (software engineering, artificial intelligence, database systems, genomics, graphics, or security)

The MS Non-thesis exam will be offered every semester, depending upon student request.

Non-thesis Project Option: (Available at Tri-Cities Campus only). The project option shall consist of at least 27 graded credits and six credits of Cpt S 702. Of the 27 credits of course work, at least 15 must be in Computer Science and must satisfy the program requirements as stated in Section 1.3.2. Specific course requirements are the same as for other CS non-thesis programs. Students are required to complete a project and submit a report on the project which is satisfactory to the advisory committee. The project should represent work equivalent to two three-credit hour graduate courses and the quality equivalent to a grade of "B" or better.

Note: Students must have a BS degree in Computer Science or have completed the equivalent of the following WSU courses: Cpt S 121, 122, 223, 260, 317 355, 360, 450; Phil 201 and Math 216 before admission to the MS program in Computer Science

1.4.3 Non-Thesis Option in Computer Engineering

Under the non-thesis option, the student is required to take at least 28 credits of graduate level course work plus two credits of EE 702. Of the 28 credits of course work, at least 12 credits must be from the following courses:

- EE 530 Digital Signal Processing

- EE 554 Asynchronous Digital Systems
- EE 586 VLSI Systems Design
- EE 524/EE 561 Advanced Computer Architecture
- Cpt S/EE 555 Computer Communication Networks or EE 503 Structure, Dynamics and Control of Large-Scale Networks
- Cpt S 560 Operating Systems
- EE 587 System on Chip Design and Test

A maximum of six credits or 400 level course work approved by the GSC may be included. One 3-credit Directed Study (EE 595) may be included. The student is required to follow the procedures described above for the thesis student and form an advisory committee to assist them in designing a program for this option. In particular, the student's advisor must approve the student's course program. The student following the course option must take a comprehensive examination. The student must show proficiency in computer engineering and pass the exam.

Students may take the MS comprehensive exam only twice. A failure to pass the examination for the second time will result in a recommendation for dismissal from the graduate program.

1.5 Transfer Credits from Other Institutions

Transfer of graduate course work earned at another university is subject to the following proce dure:

1) During the first year at EECS, students will submit a written petition with supporting materials (e.g., transcript, course outline, exams, projects, catalog description, etc.) to their research advisor for an initial evaluation.
2) If supportive, the advisor begins an in-depth review process by sending a note to the graduate program coordinator who assigns the case to an appropriate faculty member for further review.
3) The selected faculty member evaluates the materials, interviews the student if necessary, and provides one of the following written recommendations:
    a. Transfer approval as a substitute for an equivalent EECS graduate course (3 credits);
    b. Transfer approval as a graduate course appropriate for EECS (1-3 credits);
    c. Transfer denial.
    d. No more than six (6) transfer credits will be approved for a Master's program.
    e. No more than seventeen (17) transfer credits will be allowed for a Doctoral program.

1.6 Annual Progress Review

Each year the progress of every student will be reviewed. A written and signed copy of the review is to be placed in the student's file, and a copy will be available to the student. This review, conducted by the Graduate Faculty, should indicate the student's progress on course work and on the thesis. The review will be conducted in spring semester, unless there is reason for a fall review.

Students on appointment must reapply for assistantship every semester and will not be reappointed if performance and progress are deemed unsatisfactory.

1.7 Timetable for All MS Degree Students

1) Submission of program and advisory committee nomination (as soon as possible and before fifteen credits have been earned toward the MS degree). Failure to file a program will result in cancellation of any state support, such as teaching assistantship.
2) Application for MS degree (prior to the middle of the last semester). See the current "Tabular Summary" from the Graduate School for the dates.
3) Approval of the thesis. Theses must receive preliminary approval from the advisory committee before the final examination is scheduled. Committee members must be given 14 days (10 working days) to review the thesis prior to scheduling the final exam.
4) Scheduling of final master's examination for thesis option at least 14 days (10 working days) before requested final examination date.
5) Request to take final master's exam for non-thesis option must be submitted before beginning of the semester during which it is scheduled.
6) Distribution of printed thesis to the advisory committee, the Graduate Studies Committee representative (at least five days before the requested final examination date), and a copy to the Graduate School office (at least ten working days prior to the examination date).
7) Final examination.
8) Change of EE/Cpt S 700/702 grades from 'X' to 'S' will occur only following successful completion of the final examination and after the thesis has been filed with the department office.

1.8 Guidelines for EE 595 and Cpt S 595 (Directed Study)

1) Faculty and student should provide an abstract of the planned work by the end of the third week of the semester. A copy of the abstract should be filed with the graduate secretary.

2) A report describing the work must be submitted at the end of the semester. If a conference or journal paper or Tech Report is generated, a separate report is not necessary.

1.9 Reinstatement Policy

Graduate students whose cumulative GPA falls below 3.0 are academically deficient and must be reinstated to continue in the program. They may be reinstated only once. If the cumulative GPA is below a 3.0 the following semester(s) the student may apply for reinstatement until the deficiency is removed provided the semester GPA is 3.3 or higher each semester.

CHAPTER 2

EECS GRADUATE PROGRAM REGULATIONS

Doctor of Philosophy

The university requirements for doctoral programs are specified in the "Graduate School Policies and Procedures" and shall not be repeated here. It is the student's responsibility to become familiar with this information. The policies and procedures unique to the PhD programs in Electrical Engineering and Computer Science are listed below.

2.1 Admission

The School evaluates applicants for admission to the Doctoral program based on college transcripts, GPA, the score on the general GRE, letters of recommendation, a statement of purpose, and TOEFL score, if applicable. All the materials except the statement of purpose should be sent to the Graduate School at P. O. Box 641030, Pullman, WA 99164-1030 or if you use express mail such as FedEx or DHL, send them to the Graduate School, French Administration Building, Room 324, Pullman, WA 99164-1030. The statement of purpose and additional materials such as publications or research activity may be submitted to the department via e-mail attachments, if desired... The Graduate Studies Committee will consider these materials and students judged most qualified will be offered admission. (Admission does not guarantee assistantship support.)

2.2 Registration Requirements

Each graduate student receiving financial support from the School of Electrical Engineering and Computer Science in the form of teaching or research assistantship or fellowship must register for 16 credit hours each semester. At least nine of these credits should be graded courses, unless the student is near the end of the program and the course work is near completion. The remainder of the credits may be made up of research credits, i.e., EE or Cpt S 800.

Full-time students who are self-supporting should register for at least 10 credit hours each semester, but may choose to register for more.

Students considering dropping or withdrawing from a course that will put them below the requirements listed above should have the approval of their advisor and/or the Graduate Coordinator.

2.3 The Program of Study and Advisory Committee

Upon admission to the PhD program, each student is advised by the EE or CS Graduate Coordinator or by a faculty member acceptable to the student and the coordinator, but the student should find an advisor as soon as possible. The program of study should consist of approximately 45 credits of graded course work plus 30 or more research credits (Cpt S or EE 800). A maximum of 6 credits of Directed Study (CptS or EE 595) may be included. A maximum of 9 credits of 400 level course work approved by the GSC may be included. In general, undergraduate courses REQUIRED for the BS/CS, BS/EE or BA/CS and undergraduate courses listed as pre-requisite for admission into the MS/PhD in CS or EE program will NOT BE allowed. This program becomes the student's official study plan after approval by the doctoral committee (described below), the GSC of EECS, and the Graduate School.

In addition to specifying a program of course work, the program of study also lists the proposed doctoral committee, which becomes official upon approval by the Graduate School. The doctoral committee consists of three or more faculty. At least three (including the major advisor or Chair of the committee) must be members of the WSU Permanent (i.e. non-Adjunct) Graduate Faculty, of which the major advisor and another member must be members of EECS Permanent Graduate Faculty. The Chair of the advisory committee must be a specialist in the student's intended area of research and the supervisor of the research. The committee and the advisor, who chairs the committee, are nominated with the approval of the student, the director of School of EECS (or the director's designee), and the prospective committee members. The doctoral committee membership or the course work program may be changed with the approval of the student, the director of School of EECS (or the director's designee), the new committee members, and the Graduate School.

Suggested programs of study for students in each research area are outlined in Section 2.13.

2.4 Specific Program Requirements

2.4.1 Ph.D. in Computer Science Degree Program:

The program of course work for the PhD in Computer Science must include at least four of the following core courses:

- Cpt S 515, Advanced Algorithms
- Cpt S 516, Automata Theory
- Cpt S 543, Human Computer Interaction
- Cpt S 550, Parallel Computation

- Cpt S 555, Computer Communication Networks
- Cpt S 560, Operating Systems
- Cpt S 561, Computer Architecture
- Cpt S 564, Distributed Systems
- Cpt S 521, Software Engineering Analysis
- Cpt S 527, Computer Security
- Cpt S 542, Computer Graphics
- Cpt S 541, Artificial Intelligence
- Cpt S 551, Database Systems
- Cpt S 580, Computational Genomics

The Cpt S graduate course categories are listed in Appendix A.

All the required courses must be successfully completed within three semesters of admission to the program. Students may petition the Graduate Studies Committee (GSC) to include transfer credits, but only if equivalent courses are offered at the graduate level, are completed in a recognized graduate school as a graduate student, and are clearly consistent with the objectives of the student's PhD program at WSU. Any transfer credits used toward the PhD must comprise no more than 17 credits and such use is subject to the approval of both the doctoral committee and the Graduate School. Refer to Section 1.5 for the procedure to request graduate level transfer credits.

2.4.2 Ph. D. in Electrical and Computer Engineering Degree Program:

The program of course work for the PhD in Electrical and Computer Engineering must include at least three of the following eight core courses:

- EE 501 Linear System Theory
- EE 503 Structure Dynamics and Control of Large-Scale Networks **OR**
- EE 555 Computer Communication Networks*
- EE 507 Random Processes In Engineering
- EE 518 Advanced Electromagnetic Theory

- EE 521 Power Systems Analysis
- EE 524 Digital Systems Architecture
- EE 596 Advanced Analog Integrated Circuits
- Cpt S 516 Automata Theory

***Note**: Only one course from EE 503 and EE 555 can be counted as one of the three required core courses.

All core courses must be successfully completed within three semesters of admission to the program. Students may petition the Graduate Studies Committee (GSC) to include transfer credits, but only if equivalent courses are offered at the graduate level, are completed in a recognized graduate school as a graduate student, and are clearly consistent with the objectives of the student's PhD program at WSU. Any transfer credits used toward the PhD must comprise a maximum of 17 and these are subject to the approval of both the GSC and the Graduate School. Refer to Section 1.5 for the procedure to request graduate level transfer credits.

2.5 Advanced Graduate Standing (AGS)

AGS is the departmental designation for official permission to pursue a PhD degree. The Graduate Studies Committee (GSC) grants AGS status. The GSC considers a student for AGS within three weeks of completing the PhD Qualifying Exam. The process of evaluation of AGS is based on:

a) The student's performance on the PhD qualifying examination,
b) Performance in graduate courses,
c) Letter of recommendation from the student's research advisor, and
d) Other information pertinent to the student's ability to perform high-quality doctoral-level work.

The Graduate Studies Committee may:

1) Grant AGS,
2) Grant AGS with specified conditions,
3) Grant continuation in the program with reevaluation by the GSC after specified conditions are satisfied, and
4) Terminate the student from the PhD program.

(Only students granted AGS can be appointed RA II or TA II.)

2.6 Qualifying Exam

The purpose of the PhD qualifying exam (QE) is to assess the student's depth and breadth of knowledge suitable for the doctoral program. Passing the QE is required for Advanced Graduate Standing (AGS), the status that permits students to pursue the PhD degree.

This examination will be taken no later than the end of the student's third semester in the PhD program. The exam will be given each year in September and, if demand warrants, in February. If any area committee chooses not to offer its exam in February, the student may postpone that area exam for one semester. Students must sign up for the exam in the second semester in the program, or no later than the second week of the third semester. Engineering students must at this time specify their areas of depth and breadth. Area committees in Electrical and Computer Engineering should administer major area examinations by the end of the fourth week of the semester and the minor area examinations by the end of the sixth week of the semester. The QE in Computer Science should follow the same general schedule. The results of the examinations should be reported to the GSC by the end of the seventh week of the semester. The GSC should meet soon afterwards to discuss the results.

2.6.1 Electrical and Computer Engineering QE

The doctoral program in Electrical and Computer Engineering is broadly divided into the following five areas:

1) Computer Engineering
2) Electrophysics (Electromagnetics, Waves, Solid State)
3) Energy and Power Systems
4) Microelectronics
5) Systems (Communications, Controls and Signal Processing)

The students in the PhD EE program are required to take two exams: one in their primary (depth) area and a second (breadth) area of their choice. The examination in each area is not, in principle, tied to any particular WSU course; however, it is expected to be at the first-year graduate-level in each area. Each area has specific guidelines regarding the nature and format of the exam as described below. The examining committee in each area will provide a written evaluation of the performance of each student to the GSC. The major advisor of a student taking an exam should not be part of that examining committee, and (if a member of the graduate studies committee) will be excused from deliberations and voting. Students must perform satisfactorily in both areas in order to pass the QE.

Descriptions of Area Exams:

Computer Engineering

Effective fall 2008, the computer engineering examination will be a written exam lasting two hours, and will consists of eight questions: two each from EE 524 (Cpt S 561) and EE 586 and EE 587 and one each from Cpt S/EE 555 and EE 503. Students whose major area is computer engineering are required to answer a total of five out of the eight questions. Students taking the exam as their minor area must choose to answer four from the eight questions.

The computer engineering area examination committee will provide an assessment of each student's performance on the CE qualifying exam to the Graduate Studies Committee within two weeks after the date of the exam.

Performance assessment guidelines for students majoring in the CE area: The three possible performance assessments for students specializing in the CE area will be: (1) Pass; (2) Fail, but be allowed to retake the exam the next time it is offered; (3) Fail, should not be allowed to continue in the CE area. Each question on the computer engineering qualifying exam will be worth 20 points. Students specializing in the computer engineering area will automatically pass the exam if they score 80 or higher. Depending upon the particular exam, the examining committee may set the pass/fail threshold lower than 80. Computer engineering students who fail the exam on their first attempt but who achieve a score within 15 points of the pass/fail threshold will be assessed at performance level 2 (see above). Computer engineering students who fail to achieve a score greater than or equal to 15 points below the pass/fail threshold on their first attempt, or who fail the exam on their second attempt, will be assessed at performance level 3 (see above).

Performance assessment guidelines for students not majoring in the computer engineering area: (1) Pass, score 65 or above; (2) Fail, score above 50 and below 65, recommended to retake once; (3) Fail, score below 50, recommended to retake once after fulfilling the conditions imposed by the computer engineering exam committee such as taking additional courses in the CE area.

Electrophysics (Electromagnetics, Waves, Solid State)

The electrophysics (EP) qualifying exam shall be offered in September. If demand warrants, it will also be offered in February. Students must register for the qualifying exam one semester before it is given. All doctoral students specializing in the electrophysics area (or in wave propagation) will be required to take the EP qualifying exam and a breadth exam in another area no later than the end of their third semester of study in the Ph.D. program.

The EP qualifying exam will be a written exam lasting two hours and consisting of nine questions: four from EE 518, and one each from five of the following courses: EE 431, EE 432, EE 496, EE 504, EE 517, EE 519, and EE 526. The latter questions will be chosen on the basis of which courses were offered most recently. Students with EP as their primary (depth) area must choose five questions to answer from these nine. A maximum of three questions can be from EE 518. Students with EP as their secondary (breadth) area must choose four questions to answer

from the nine questions. A maximum of three can be from EE 518. The exam is closed notes. Students are allowed to use a calculator, a handbook of mathematical tables, and one textbook of their choice.

The EP examination committee will submit an assessment of each student's performance to the Graduate Studies Committee within two weeks of the exam. Each question on the exam is worth 20 points.

The possible assessments for students with EP as their primary area are: (1) Pass; (2) Fail, but may be allowed to retake the exam the next time it is offered; and (3) Fail, should not be allowed to continue. Students will pass the exam automatically if they score at least 70 out of the 100 possible points. Students who achieve a score of at least 55 but less than 70 will be assessed at performance level (2). Students who score below 55 or who fail the exam on their second attempt will be assessed at performance level (3).

The possible assessments for students with EP as their secondary area are: (1) Pass and (2) Fail. Students will pass the EP breadth exam if they score at least 50 out of the 80 possible points.

Energy and Power Systems

The examination will be for three hours. There will be eight problems in the exam out of which any five can be attempted. The five questions will be of twenty points each. The scores out of 100 will then be forwarded to the graduate studies committee along with some specific recommendations on each student. The performance criteria will be different for students taking the exam for depth from those for breadth. Each of the students will be given feedback on their performance in the written exam in the form of informal discussions with the examination committee. The topics for the qualifying exam are stated below. The topics are also accompanied by a listing of recommended textbooks.

Topics for the exam:

Power system fundamentals:
Three-phase circuits, Balanced three phase networks, Concepts of real and reactive power, Transmission line inductance, capacitance and reactance computations, Short, medium and long line representations, Transformer representation, Principles of electromechanical energy conversion, Synchronous machines, Induction machines, Phasor diagrams. Textbooks: Grainger and Stevenson book, Yamayee and Bala book.

Power-flow methods:
Power-flow equations, Gauss-Seidel algorithm, Newton-Raphson and fast decoupled algorithms, Convergence issues, Reactive power limits, Sparsity issues, Static limits, Phase-shifting transformers, shunt capacitor banks, and synchronous condensers, Basics of contingency analysis. Textbooks: Grainger and Stevenson book, Glover and Sharma book.

Modeling of dynamic components:

Synchronous generators: electromagnetics, electro-mechanics, exciters, governors, power system stabilizers; Construction of multi-machine network models. Textbooks: Kundur book, Fouad and Anderson book.

Stability analysis:
Small-signal stability: local linearization, eigenvalues, modes of oscillation, small-signal stability limits; Transient stability: equal area criterion, multi-machine transient stability analysis, transient stability limits; Concepts of voltage stability and angle stability. Textbooks: Kundur book, Fouad and Anderson book.

Power system controls:
Principles of exciters and governors, basics of automatic generation control, basics of voltage controls: shunt capacitor banks and condensers. Textbooks: Grainger and Stevenson (voltage controls), Kundur book and Fouad Anderson book (dynamic controls).

Economy methods:
Economic load dispatch: classical lossless and lossy line computations, formulation of optimal power-flow, principles of optimal power-flow algorithms and hydro-thermal coordination methods. Textbook: Grainger and Stevenson book.

Operation issues:
State estimation problem, principles of state estimation algorithms, basics of secondary control architecture. Textbook: Grainger and Stevenson book.

Protection issues:
Basics of symmetric components, formulation of positive, negative and zero sequence networks, fault computations, introduction to types of relays. Textbook: Glover and Sharma book.

Microelectronics

Students declaring microelectronics as their major field will complete a two-part evaluation. The examining committee will first select between 3 and 5 relevant research papers from which the student will have 3 weeks to provide a 5 page double-spaced paper summarizing and interpreting the research in these papers. After the student has submitted this written report to the committee, there will be an exam scheduled where the student will present these results in a 20-30 minute presentation. After this time, the committee will have an oral question and answer period to assess the student's knowledge of the fundamentals and analytical abilities.

The microelectronics area examination committee (consisting of three faculty and may not include the student's advisor) will provide an assessment of each student's performance to the graduate studies committee within two weeks after the date of the oral exam.

Performance assessment guidelines for students majoring in the microelectronics area:

The three possible performance assessments for students specializing in the microelectronics area will be: (1) Pass; (2) Fail, but may be allowed to retake the exam the next time it is offered; (3) Fail, should not be allowed to continue in the microelectronics area.

Students choosing microelectronics as a minor will take a written exam and must score above 70 to pass. If the student does not pass, the student may retake the exam the next time it is offered. If the student fails after taking the exam twice, the student will not be allowed to declare microelectronics as the minor field.

Systems (Communications, Control and Signal Processing)

Effective fall 2000, the systems qualifying exam will be a written exam lasting 3 hours, and will consist of 7 questions: two each from EE 501 and EE 507, and one each from EE 451, EE 464, and EE 489. Students are required to answer a total of 5 out of the 7 questions. Four of the 5 required answers must be to the questions from EE 501 and EE 507; these questions will clearly be identified on the exam as REQUIRED. The other question must be chosen from among the questions for courses EE 451, EE 464, or EE 489; these questions will be placed in a separate section of the exam, and will be identified with a section cover page stating: answer ONE of the following three questions. The exam will be closed book, closed notes. Calculators will not be allowed on the exam. Students will be allowed to bring in one handbook of mathematical tables (such as a CRC handbook), and two 8.5" x 11" study sheets per course (front and back may be used).
The systems area examination committee will provide an assessment of each student's performance on the systems qualifying exam to the graduate committee within two weeks after the date of the exam.

Performance assessment guidelines for students majoring in the systems area:

The three possible performance assessments for students specializing in the systems area will be: (1) Pass; (2) Fail, but be allowed to retake the exam the next time it is offered; (3) Fail, should not be allowed to continue in the systems area. Each question on the systems qualifying exam will be worth 20 points. Students specializing in the systems area will automatically pass the exam if they score 80 or higher. Depending upon the particular exam, the examining committee may set the pass/fail threshold lower than 80. Systems students who fail the exam on their first attempt but who achieve a score within 15 points of the pass/fail threshold will be assessed at performance level (2) above. Systems students who fail to achieve a score greater than or equal to 15 points below the pass/fail threshold on their first attempt, or who fail the exam on their second attempt, will be assessed at performance level (3).

Performance assessment guidelines for students not majoring in the systems area:

a) Pass, score 60 or above
b) Fail, score above 40 and below 60, allowed to retake once

c) Fail, score below 40, allowed to retake once, after fulfilling the conditions imposed by the system exam committee such as taking additional courses in system area.

2.6.2 Computer Science QE

The Computer Science Qualifying Exam consists of two parts: a breadth requirement, satisfied by outstanding performance in course work, and a written and oral exam designed to assess students' readiness to undertake research at the PhD level.

2.6.2.1 Breadth Requirement

A student must take at least 15 graded credits of computer science courses (i.e., excluding Cpt S 595 and Cpt S 500) at the 500 level. A grade point average of 3.70 must be obtained in these courses. A course with a grade below B cannot be applied toward this requirement. The courses must include Cpt S 515 or 516 and courses from at least two other areas listed in Appendix A.

Graded graduate credits transferred from other institutions may be used to fulfill up to 6 credits of the breadth requirement.

2.6.2.2 Written and Oral Examination Structure

The written and oral qualifying examination is normally taken following completion of the breadth requirement, in the 3rd semester following admission to the WSU PhD program in Computer Science. It must be taken prior to the completion of 21 graded graduate credit hours in the PhD Program at WSU. This examination is intended to ascertain the student's readiness to undertake research at the PhD level. The student will be examined in one area selected by the student from the list of approved areas. (Appendix A).

The exam is a take-home exam given on a Friday and due the following Tuesday. On the following Friday, the committee administers the oral portion of the exam. For the examination, the student is given a set of research questions and a set of related research papers. The student prepares a written report of 10-20 pages based on the papers and the questions. The oral exam consists of a presentation and defense by the student of the answers to the research questions, which can be expected to take up most of the examination. Students should also expect some general questions not directly related to the take-home questions.

If a student fails the exam, it may be retaken once during the following semester.

The retake need not be in the same area as the failed examination, but only one retake is allowed.

2.6.2.3 Written and Oral Examination Procedure

At the end of each semester an e-mail is sent to PhD students due to take the qualifying exam the following semester, asking in which area they wish to be examined. For each selected area, the Director (or his/her designee) assembles three faculty members to serve as the examining committee for that semester. At least two of the faculty members should be experts in some part of that area. The advisor may be a member of such a committee. The committee then writes an exam in the area. Multiple students taking an exam in the same area may receive different exams because students may have taken different courses in a single area.

2.6.2.4 Qualifier Expectations

Students should have done work equivalent to taking 500-level courses in the examination area. They must be able to read and comprehend the recent literature in that topic area, and be able to critique and compare the motivations, methods, and results of the work. They must be able to find related material in the library and on the Internet. They must be able to write a scholarly report on a collection of papers that includes reviews of the papers and conclusions produced by synthesizing information from multiple papers. They must be able to orally present their findings with overheads or slides to the examination committee. They must be able to answer technical questions about the material they read and present.

2.6.2.5 Grading and Decision-making

Each committee grades the exams in their area and reports the results to the CS graduate faculty. Each report includes a pass/fail recommendation and a summary of the student's performance on the exam. If no objections to the results are raised within 7 days, the committee's recommendation stands. Otherwise, the graduate CS faculty meets to discuss the matter and decides by majority vote whether the student passes.
A number of questions regarding the Computer Science Qualifying Exam are addressed tin Appendix B.

2.6.3 Timetable for QE

1) Near the end of every semester, the graduate secretary will identify students who are required to take the examination and inform them that they should sign up.
2) By the end of the semester students must sign up for the exam. EE students must identify the two areas (depth and breadth) in which they desire to be examined. The students are required to coordinate with the chair of the appropriate area committee(s). Each area committee will choose exam dates in September and (if offered twice) February.
3) The examination is constructed during the summer/semester break and available to faculty one week prior to the examination date.
4) The exam is administered according to the schedule set by each area committee.
5) Area committees must have recommendations to the Graduate Studies Committee within two weeks after the exam is administered.
6) Graduate Studies Committee decisions on Advanced Graduate Standing will be issued no later than one week after the last area committee has reported to the GSC.

2.7 Teaching Fellowship

PhD students who have passed the qualifying exam and obtained Advanced Graduate Standing are encouraged to apply for instructor appointments. These one-semester appointments involve full responsibility for teaching an undergraduate course and generally provide a higher level of pay than RA/TA appointments. Three letters of recommendation from EECS faculty, including one from the student's advisor, are required.

2.8 Annual Progress Review

Each year the progress of every student will be reviewed. A written and signed copy of the review is to be placed in the student's file, and a copy will be available to the student. This review, conducted by the Graduate Faculty, should indicate the student's progress on course work and research.

Students on appointment must reapply for assistantship every semester and will not be reappointed if performance and progress are deemed unsatisfactory.

2.9 The Preliminary Examination

A doctoral student is advanced to candidacy when he/she passes the preliminary examination (PE). The PE should be held no later than the fifth semester of the student's PhD program. If unsuccessful, a student may be allowed to take this examination one more time. The overall format for the PE is described in the WSU Graduate Student Handbook. The specific format of the EECS PE is described below.
The PE is administered by the student's doctoral committee. The purpose of this exam is to ascertain the capability of the student to perform the proposed research, and the quality and the appropriateness of the project. The PE consists of two parts: a research capability exam administered by individual committee members, and a dissertation proposal exam, which is administered by the whole committee (and any other interested EECS graduate faculty member), and observed by the Graduate School representative.

The research capability exam will be scheduled by the student with individual committee members in the two weeks before the scheduled dissertation proposal exam. This exam can be written or oral or both and each committee member must provide a written evaluation of the student's capability to do research.

The Ph.D. student will submit an 8 to 12-page (single-spaced) "Dissertation Proposal" to the GSC, BEFORE scheduling the Ph.D. preliminary examination and AFTER passing the PhD qualifying examination. This document shall describe the student's intended Ph.D. research in reasonable detail - including introductory and background material, preliminary research conducted, plans for further research and bibliography. The proposal may serve as the focus for the preliminary exam, although this is not required. Also, there should be a MINIMUM period of

SIX (6) months between passing the preliminary exam and taking the Ph.D. final exam (i.e. dissertation defense). The dissertation proposal exam must be scheduled and posted according to the Graduate School regulations. The exam itself will consist of the presentation of the proposal by the student and questioning from the committee and graduate faculty. The vote on the PE will be held at the end of the exam. The evaluation of each committee member of the student's research capability exam will be available to all voting faculty.

2.10 The Final Examination

An oral final examination is given after the completion of the dissertation. This examination (open to the public and publicized in the WSU newsletter, "WSU Today") is primarily a defense of the dissertation. Along with the scheduling form for the PhD Final Exam, a List of Publications (accepted, submitted or in preparation) should be submitted to the GSC. The publication list should include date of submission or appearance (or anticipated date) and the full name of the conference or journal. **Note:** The scheduling form will not be signed unless at least one paper has been submitted for publication. The student's doctoral committee must attend and vote and any other member of the WSU Graduate Faculty may also attend and vote. Graduate students often attend PhD oral examinations as spectators. The student must file a form indicating preliminary approval of the dissertation; this form also specifies the examination location, date, and time.

2.11 The Dissertation

If the student's dissertation is approved and the oral defense is passed, the student must provide a bound copy of the dissertation to the School of EECS. Dissertations must be formatted in accordance with University and School requirements, and all changes suggested by the doctoral committee must be made in the final version. The results of the dissertation research should be submitted to a refereed journal.

2.12 Timetable for PhD Students

1) Application to take the qualifying exam, passing exam and receiving AGS status.
2) Scheduling of preliminary examination (after completion of a majority of the doctoral program's course work). Forms must be filed with the Graduate School at least ten (10) days prior to the examination date.
3) Application for degree (apply during the semester prior to the date the final oral exam is scheduled).
4) Committee members must be given 14 days (10 working days) to review the dissertation prior to scheduling the final exam.

5) Submission of dissertation to the Graduate School (after approval by the doctoral committee and at least 14 days (10 working days) prior to scheduled date of the final oral exam).

6) Payment of the graduation fee and the dissertation-microfilming fee (these are one-time only fees. Be sure to keep the receipts).

7) Schedule final oral exam (schedule at least ten (10) days prior to exam date).

2.13 Suggested Programs of Study for the PhD

2.13.1 Computer Engineering

A Doctor of Philosophy Degree would normally include 45 hours of course work beyond the BS degree of which no more than nine hours is at the senior level. Computer Engineering is a broad field which may include unique course selections from other areas, including electronics, communications, systems and controls, and electromagnetics. A typical program may include 12 or more hours from Computer Science. Further, three or more hours of mathematics would be included as part of the combined MS and PhD course work. An example program is given below.

EE 501 Linear System Theory
EE 507 Random Processes in Engineering
EE 524 Advanced Computer Architecture
EE 554 Asynchronous Digital Systems
EE 555 Computer Communication Networks
EE 562 Fault Tolerant Computer Systems
EE 586 VLSI Systems Design
EE 596 Advanced Analog Integrated Circuits
Cpt S 516 Algorithmics
Cpt S 544 Neural Computation
Cpt S 550 Parallel Computation
Cpt S 560 Operating Systems
Cpt S 566 Embedded Systems
Cpt S 565 Distributed Systems
Math 553 Graph Theory

2.13.2 Electrophysics (Electromagnetics, Waves, Solid State)

A Doctor of Philosophy Degree would normally include 45 hours of course work beyond the BS degree of which no more than 9 hours is at the senior level. At least 6 hours of mathematics should be included as part of the combined MS and PhD course work. An example program is given below.

EE 501 Linear System Theory
EE 505 Nonlinear System Theory
EE 504 Modern Optics

EE 507 Random Processes in Engineering
EE 516 Remote Sensing Theory
EE 517 Numerical Solutions to EM Problems
EE 518 Advanced Electromagnetic Theory I
EE 519 Advanced Electromagnetic Theory II
EE 527 Special Topics in EM
EE 564 Advanced Signal Processing
Cpt S 445 Digital Image Processing
Cpt S 547 Statistical Pattern Recognition
Math 503 Complex Analysis
Math 540 Partial Differential Equations I
Math 564 Topics in Optimization

2.13.3 Energy and Power Systems

A Doctor of Philosophy Degree would normally include 42 hours of course work beyond the BS degree of which no more than 9 hours is at the senior level. Normally, 12 hours of course work from outside of EE would be included as part of the combined MS and PhD program. An example program is given below.

EE 501 Linear System Theory
EE 505 Nonlinear System Theory
EE 507 Random Processes in Engineering
EE 511 Protection of Power Systems II
EE 521 Analysis of Power Systems
EE 522 High Voltage Engineering
EE 518 Advanced Electromagnetic Theory I
EE 581A Power System Operation
EE 581B Advanced Power System Analysis
EE 529 Utility Applications of Power Electronics (University of Idaho)
Cpt S 442 Computer Graphics
Cpt S 450 Design and Analysis of Algorithms
Math 448 Numerical Analysis
Math 544 Advanced Matrix Computation

2.13.4 Microelectronics

A Doctor of Philosophy Degree would normally include 42 hours of course work beyond the BS degree of which no more than 9 hours is at the senior level. An example program is given below.

EE 501 Linear System Theory
EE 505 Nonlinear System Theory
EE 507 Random Processes in Engineering

EE 518 Advanced Electromagnetic Theory I
EE 524 Advanced Digital System Architecture
EE 530 Multirate Signal Processing
EE 551 Data Communication Systems
EE 564 Advanced Signal Processing
EE 574 Optoelectronics
EE 582 Special Topics in Microelectronics
EE 586 VLSI Systems Design
EE 596 Advanced Analog Integrated Circuits
EE 597 Semiconductor Device Modeling
EE 598 High Speed Semiconductor Devices
Phys 450 Introduction to Quantum Mechanics

2.13.5 Systems (Communications, Control & Signal Processing)

A Doctor of Philosophy Degree would normally include 45 hours of course work beyond the BS degree of which no more than 9 hours is at the senior level. Typically, 6 hours of mathematics would be included as part of the combined MS and PhD course work. An example program is given below

EE 501 Linear System Theory
EE 502 Linear Multivariable Theory
EE 503 Structure, Dynamics, and Control of Large-Scale Networks
EE 505 Nonlinear System Theory
EE 507 Random Processes in Engineering
EE 509 Adaptive Control
EE 530 Multirate Signal Processing
EE 543 Signal Theory
EE 545 Data Compression
EE 551 Data Communication Systems
EE 555 Computer Communication Networks
EE 564 Advanced Signal Processing
Cpt S 516 Algorithmics
Cpt S 544 Neural Computation
Cpt S 545 Computer Vision
Math 401 Introduction to Analysis
Math 501 Real Analysis

2.13.6 Computer Science

A Doctor of Philosophy degree in computer science would normally include 45 hours of course work beyond the BS requirements, of which not more than 9 hours is at the senior level. Doctoral study in Computer Science typically involves at least 6 hours of courses in other disciplines. The

CS graduate student may find it useful to choose such courses from the following suggested lists of course programs suggested by the faculty:

Suggested courses for Computer Networking PhD research topic

Cpt S 516 Algorithmics
Cpt S 555 Computer Networks
Cpt S 564 Distributed Systems
Cpt S 557 Adv. Computer Networks
Cpt S 562 Fault Tolerant Computer Systems
Cpt S 527 Computer Security
Cpt S 560 Operating Systems
Cpt S 422 Software Engineering
Cpt S 460 Operating Systems & Computer Architecture
Cpt S 425 Network Security
Cpt S 580: Any suitable offering
EE 507 Random Processes
Math 553 Graph Theory
Math 566 Optimization in Networks
Stat 544 Applied Stochastic Processes

Suggested courses for Software Engineering PhD research topic:

Cpt S 516 Algorithmics
Cpt S 564 Distributed Systems
Cpt S 527 Computer Security
Cpt S 560 Operating Systems
Cpt S 521 Software Engineering Analysis
Cpt S 522 Software Reuse
Cpt S 523 Software Engineering Measurement
Cpt S 524 Formal Spec. and Analysis
Cpt S 566 Embedded Systems
Cpt S 422 Software Engineering
Cpt S 423 Software Engineering Lab
Math 553 Graph Theory
Stat 544 Applied Stochastic Processes

Two other courses from
Phil 401 Seminar in Symbolic Logic
Math 505 Foundation of Mathematics
Stat 542 Applied Stochastic Models

Note: Suggested course programs for other Computer Science Ph.D. research topics will be added as research groups provide input.

CHAPTER 3

EECS GRADUATE PROGRAM REGULATIONS

Assistantships

Note: Master's students awarded research or teaching assistantships are required to choose the thesis option.

A *Research Assistantship (RA)* is a fractional-time professional appointment to assist a faculty member in a specific research project. The faculty specifies the work to be accomplished by the RA during the appointment. There is a wide latitude in the types of work an RA may do for the research effort, and the time spent in various aspects may vary widely. As a guide, a half-time appointment should average about 20 hours per week, with other fractional appointments in proportion.

A *Teaching Assistantship (TA)* is a fractional-time professional appointment. A Teaching Assistant provides professional assistance as either a grader or as a laboratory assistant. The GSC and the Associate Director make TA assignments.

The TA is expected to report to the School of EECS, one week prior to START of classes; if he/she fails to do so, the assistantship will be revoked immediately. The TA's responsibilities are not completed until the final course grading is completed, unless excused earlier by the instructor.

The specific work duties are the responsibility of the faculty member to whom the TA is assigned. TAs usually have contact with students and may teach laboratory courses or recitation sections, grade course related materials, and perform other support work for a faculty member. The TA is expected to be familiar with the course material and/or laboratory and experiments before the beginning of classes. The TA may be required to attend the lectures if so specified by the course instructor. Foreign students must have passed the English proficiency examination required by the Graduate School prior to assignment.

3.1 About Assistantships

3.1.1 Obtaining an Assistantship

A beginning graduate student who meets the admission requirements of EECS and the Graduate School is eligible to apply for a graduate Teaching Assistantship (TA) or Research Assistantship (RA). Formal application must be made to the School of Electrical Engineering and Computer Science (usually at the time of application for admission).

If an assistantship is not awarded for the first semester of graduate work, the student may apply for support for subsequent semesters by filling out an assistantship request form available from the Graduate Coordinator.

3.1.2 Work Assignments and Course Loads

Assistantship students are expected to be available for performance of their duties beginning one week prior to classes through the date grades are due at the end of the semester. Assistantships require a work commitment of about 20 hours per week.

Graduate assistants are required to choose the thesis option and must register for 16 credit hours. This total includes graded course work, and research hours.

3.1.3 Grading Assistance

A TA assigned as a grader may review, critique, and grade problem sets, exercises, reports, examinations and other written or oral material. A grader may assist in preparing programs, problem sets, and contribute to examination sets.

3.1.4 Laboratory Assistance

The lab TA assists in the laboratory by interpreting the laboratory instructions, demonstrating proper use of equipment and supplies, answering students' questions, encouraging students to perform quality work and investigating odd or unexpected results. The TA may aid in preparing experiments and exams, performing demonstrations, preparing and grading reports and examinations.

Laboratory assistance may include helping students learn computer techniques.

3.2 Continuing an Assistantship

It is the intention of the School of Electrical Engineering and Computer Science to continue financial support through the timely completion of the degree program. However, appointments are competitively based and dependent upon funding available to the school. Students must reapply every semester and continuation or renewal of an assistantship is contingent upon:

- Satisfactory academic progress,
- Satisfactory performance of assistantship duties,

- Professional and personal conduct of an exemplary nature,
- And for non-native English speaking students, passing the required oral English exam.

Students will be evaluated on the quality and quantity of work performed. The Graduate Studies Committee, with the recommendation of the student's supervisor and advisor, awards assistantship renewals.

Research Assistants
The research supervisor determines satisfactory progress.

Teaching Assistants
A student is required to enroll in 3 graded courses unless his or her course work is essentially complete.

The MS program must be filed by the end of the second semester of enrollment.
The PhD program must be filed by the end of the fourth semester of enrollment.

3.3 Definitions

Regular TA Appointment:
Any appointment resulting from the normal reappointment of existing TAs and any new appointment made from a list of candidates approved by the department at the normal fall and spring selection times (approximately November 1st and April 1st).

Special TA Appointment:
These are exceptional appointments, such as to fill unexpected mid-semester resignations, or to fill any temporary teaching assistant positions.

RA Appointment:
These appointments are offered to students by principal investigators on funded projects. The Graduate Coordinator or Associate Chair, however, should be informed of such offers as early as possibl to assist in departmental planning.

3.4 Minimum Conditions for Reappointment (RA and TA)

Only students on regular TA appointments are eligible for reappointment.
Students who once held but do not currently hold appointments are to be placed in competition with new applicants for available positions.
The department has established the following criteria as the minimum standard for reappointment. (Reappointments are subject to the availability of positions.)

1) Satisfactory progress in research as determined by research advisor.
2) (Teaching Assistants only) A minimum cumulative GPA will be set every semester depending upon the pool of applicants who are competing for the open positions.

3) Satisfactory progress in coursework as determined by the student's advisory committee and/or the graduate coordinator.
4) (Teaching Assistants only) Satisfactory performance as a TA as determined by faculty supervisor.
5) (Teaching Assistants only) Passage of TA oral English exam (for non-native English speaking students).

3.5 Termination Conditions

1) Unsatisfactory performance of duties as a teaching or research assistant.
2) A semester GPA below 2.5 at any time or a semester GPA between 2.5 and 3.0 for more than one semester.
3) Failure to file a program by required date.
4) Violation of academic integrity policy.
5) Failure to pass the TA oral English exam (for non-native English speaking students applying).

3.6 Changing Between an RA and TA

Students can switch from a TA position to an RA position if they find a suitable research project and arrangements are made with the principal investigator in charge of that research project and the Associate Director.

A student holding an RA position, however, cannot be automatically switched to a TA position. A formal request must be made to the Graduate Studies Committee (through the Graduate Coordinator) during the semester preceding the semester in which the change is to be effective. In addition, the student should request that the principal investigator write a letter to the Graduate Studies Committee explaining the circumstances of the RA termination and an assessment of the student's potential as a TA. This procedure applies to both MS and PhD students.

3.7 Duration of Assistantship Support

Master students in the thesis option who have had three semesters of financial support (either TA or RA) are normally not eligible for further TA support. (However, RA support may be given.) Exceptional cases where a fourth semester of support (in the form of a TA) may be warranted can be petitioned to the Graduate Studies Committee.

PhD students have a major commitment to research. As such, it is customary for a PhD student to hold an RA position. Departmental support (in the form of a TA) for PhD students is offered to some new students and some continuing students on a funds-available basis. Students holding a TA are generally expected to obtain RA support before becoming a PhD candidate (i.e., when the student passes the preliminary examination). Financial support questions for PhD students should be coordinated through their advisor.

All students should be aware that it may be necessary to work on their research during the summer even if they do not have financial support. Very few assistantship positions are available in Summer Session.

Appendix A

Computer Science Graduate Course Areas

Architecture and Operating Systems:
CptS 560 **Operating Systems**
CptS 561 **Computer Architecture**
CptS 566 **Embedded Systems**

Databases:
CptS 551 **Database Systems**

Graphics, Animation and Scientific Computation:
CptS 542 **Computer Graphics**
CptS 530 **(**Math 554) **Numerical Analysis**
CptS 519 **Introduction to Computational Geometry**
CptS 546 **Advanced Animation**
CptS 548 **Advanced Computer Graphics**

Networks
CptS 555 **Computer Communication Networks**
CptS 556 **Secure Wireless Networks**
CptS 557 **Advanced Computer Networks**
CptS 559 **Mobile Computing in Wireless Networks**
CptS 553 (Math 553) **Graph Theory**

Parallel, Distributed Computing and Fault Tolerant Computing
Cpt S 550 **Parallel Computations**
CptS 562 **Fault Tolerant Computer Systems**
CptS 564 **Distributed Systems**
CptS 565 **Advanced Distributed Systems**

Security:
CptS 527 **Computer Security**

Software Engineering
CptS 522 **Software Reuse**
CptS 523 **Software Engineering Measurement (University of Idaho)**
CptS 524**Software Specifications and Analysis**
CptS 525 **Experimental Software Engineering**

Theory, Programming Languages and Algorithms:
CptS 511 **Computational Structures**

CptS 516 **Algorithmics**
CptS 518 **Programming Language Theory**

Ai, KDD, Bio-informatics and other
CptS 534 **Neural Network Design and Application**
CptS 541 **Artificial Intelligence**
CptS 543 **Multimedia Systems**
CptS 544 **Neural Computation**
CptS 545 **Computer Vision**
CptS 547 **Statistical Pattern Recognition**
CptS 549 **Genetic Algorithms**

Note: Each specific offering of Cpt S 580 (Advanced Topics in Computer Science) will be classified into one of the above categories, based on the course content.

Appendix B

FAQ's about the CS Qualifying Exam

1. How do we deal with broadness of the areas?
   The committee designs an exam based on the student's course work.

2. How do students know how to prepare?
   The coverage of the material is based on recent 500-llevel courses offered.

3. If more than one student takes an exam in a given area will they all take it during the same week?
   Yes, but the oral examinations will be scheduled at different times.

4. What are rules for retaking the (editorial change) qualifying exam?
   If a student fails the exam, the failed examination may be retaken once, during the following semester. The retake need not be in the same area as the failed examination, but only one retake is allowed.

5. What happens if a student decides to change advisors (and area) after passing the qualifying exam?
   It does happen in some rare cases. Students are not required to do the qualifiers again. However, changing advisor and area is not encouraged after the qualifiers, except in special cases.

6. What does passing the qualifier indicate?
   The qualifier is designed to test the ability of the student to do research (which is very different from doing well in courses).