

ECE Graduate Student Handbook

14 August 2009

General Information

The Department of Electrical and Computer Engineering offers programs leading to the Master of Science (MS) and Doctor of Philosophy (Ph.D.) degrees. The MS degree may be earned under either the thesis or non-thesis options. The MS degree with the thesis option or with the non-thesis option may be earned in Electrical Engineering (EE), in Computer Engineering (CPE), or in Computer Networking (CNE). The PhD can be earned in EE or in CPE.

Many of the requirements listed in this document are set by the university. The department must follow these rules. The details of these requirements can be found in the NCSU Graduate Administration Handbook, http://www.fis.ncsu.edu/grad_publicns/handbook/. We have denoted these rules in this handbook with an asterisk, *.

Admission Requirements

Admission Fee*

No student will be considered for admission without paying the application fee. There are no application fee waivers.

Full Admission

Satisfying the minimum requirements for admission does not guarantee admission, and denial of admission does not necessarily imply a negative evaluation of an applicant's qualifications. The Department is required to limit both total enrollment and international student enrollment. Limited space and resources sometimes force limits on the number of students in certain specialties. Admission is on a competitive basis with other applying students, and it is often the case that the minimum admission requirements must be exceeded in order to obtain admission.

Minimum Requirements for Admission

The minimum requirements for admission to the M. S. degree programs in Electrical Engineering or Computer Engineering are as follows:

- A bachelor's degree from an accredited college or university in electrical engineering or computer engineering,
- An overall GPA of at least 3.25/4.00 or equivalent,
- GRE scores within the last four years from the general GRE exam. Generally successful applicants achieve minimal GRE percentiles of 70 percentile verbal, 80 percentile quantitative, and 50 percentile writing. GRE scores for students who are graduates from NCSU may be waived.

- Three strong recommendations from persons able to comment on the applicant's qualifications for graduate study.
 - All international applicants must submit TOEFL scores. The TOEFL must have been taken within two years of our receipt of the application. On the TOEFL iBT, students must have a minimum of 18 on each section of the test with a minimum total of 80. Scores on previous versions of the TOEFL are considered with the same qualitative standard. On the IELTS, we require a minimum score of 6.5 in each section. This requirement also applies to US citizens whose principal language of instruction has not been English (for example, most applicants from Puerto Rico and the Virgin Islands).
 - For GRE/TOEFL, use institution code 5496 and department code 1203.
- Students who do not have a bachelor's degree from an accredited college or university in electrical engineering or computer engineering must satisfy the completion of the following courses or the equivalent:
- Applicants for the M. S. and PhD programs in electrical engineering must have completed electrical engineering courses equivalent to ECE 109, ECE209, ECE 212, ECE 220, ECE 301(signals and systems), ECE 302, ECE 303 and ECE 305 or ECE 403.
 - Applicants for the M. S. and PhD programs in computer engineering must have completed computer engineering courses equivalent to ECE 109, ECE209, ECE 212, ECE 220, ECE 301(signals and systems), ECE 302, CSC 226 and ECE 309.
 - Applicants for all of the M. S. and PhD programs in Electrical and Computer Engineering must have also completed the following courses or equivalent courses:
 - Three semesters of calculus
 - One semester of probability/statistics
 - Two semesters of physics and one semester of chemistry.
 Applicants for the M. S. and PhD programs in Electrical Engineering and Computer Engineering must have also completed two semesters of physics and one semester of chemistry
 - Applicants for all of the M. S. and PhD programs in Computer Network Engineering must have also completed the following additional courses or equivalent:(also see <http://networking.ncsu.edu/admissions.php>):
 - Two semesters of an object-oriented language
 - Data structures
 - One semester of computer organization
 - One semester of signals and systems or discrete mathematics.

Provisional Admission

Students not satisfying minimum requirements may be granted Provisional Admission pending completion of additional work. A student holding Provisional Admission is ineligible for financial support. Students with Provisional Admission will be granted Full

Admission upon completion of nine credit hours with a minimum GPA of 3.25 and no grade lower than B, and fulfillment of minimum entrance requirements as specified under the heading above.

Financial Support

Financial Support for highly qualified students is available in the form of teaching assistantships, research assistantships, supplementary fellowships, and full fellowships. Students who have financial support in the form of teaching assistantships and research assistantships will usually meet the requirements for the Graduate Student Support Plan (GSSP). Students in the GSSP receive tuition support and health insurance.

New Student Applications for Financial Support

Prospective students may request consideration for financial assistance by completing the appropriate sections on the admission application form. All awards are made on a competitive basis.

Teaching Assistantships

Teaching assistantships (TA) are offered semester-by-semester to qualified students upon the recommendation by a research faculty member in student's specialty area. Entering students are automatically considered for financial aid at the time of admission. Continuing students can be recommended using the [TA nomination form](#) available via the ECE web site http://www.ece.ncsu.edu/academics/grad/forms/ta_recommend.doc. A half-time appointment requires approximately twenty hours of service per week. TAs may teach laboratories, grade papers or assist the department/faculty in various other ways. Reappointment as a TA is dependent upon satisfactory performance of the TA assignment and the following:

- M.S. students are eligible to hold a TA for four semesters
- Ph.D. students with an M.S. are eligible to hold a TA for four semesters following enrollment. Ph.D. students who hold only the B.S. degree are eligible to hold a TA for six semesters.
- All students holding TAs are expected to be registered in full-time status, and maintain an overall GPA of at least 3.333. Full-time is defined in the Graduate Administrative Handbook, http://www.fis.ncsu.edu/grad_publicns/handbook/, section 3.15c. A maximum of nine credit hours is permitted during each semester that the student holds a TA. Special permission can be obtained to permit up to 12 hours under unusual circumstances.
- International students must demonstrate their proficiency to speak and understand spoken English in order to have a satisfactory performance rating. The Spoken English Assessment Test (SPEAK) test may be used to demonstrate proficiency. (see http://www.fis.ncsu.edu/grad_publicns/itainfo.htm) A SPEAK test score of 45, or the equivalent score on the oral re-exam, is required to maintain a TA after two semesters at NCSU. Alternatively, a score of at least 23 on the Speaking section of the TOEFL iBT is acceptable.

Research Assistantships

ECE Faculty Members provide most Research Assistantships (RAs). They are usually twelve-month appointments, and carry stipends that depend on the assistant's qualifications and available funding.

Fellowships

College of Engineering - Dean's Fellowships

The College of Engineering offers supplementary fellowships for U.S. citizens. These fellowships provide payment of tuition, provide stipends of \$10,000, \$5,000 or \$2,000 and have no service requirement. These are one-year fellowships, and offered to new students only. In order for applicants to be considered, GRE scores are required. The recipient must hold at least a 1/4-time assistantship. The ECE Director of Graduate Programs selects nominees and awards are made by the College of Engineering.

Special Awards for Minority Students

- **African-American Assistance Grants**

These grants may be awarded to either new or continuing students holding assistantships. They carry no additional service requirement and stipends of either \$2000 or \$3000, depending on need. The ECE Director of Graduate Programs submits nominations and the Graduate School makes the awards.

- **Minority Presence Grants**

These grants are nonrenewable and are primarily for new students. They are restricted to residents of North Carolina. The ECE Director of Graduate Programs submits nominations and the Graduate School makes the awards.

University Research Assistantships

These are nine-month, nonrenewable Research Assistantships for new students. They carry work requirements of up to 1/4-time and average stipends of \$250/mo. They must be supplemented with a departmental appointment. Nonresident tuition remission *may* be provided upon approval of a written request from the ECE Director of Graduate Programs.

Other Fellowships

Numerous other companies and government agencies award grants and fellowships. Typical applicants for these fellowships have exceptional academic records (GPA of at least 3.75) and GRE Scores of above the 90th percentile. They have superior recommendations and usually participate in several honor/professional societies and extracurricular activities. Notices for these grants and fellowships are posted on the ECE Graduate Office bulletin board.

Course Load

Any student holding a TA or RA who receives tuition remission and medical insurance must register for full-time enrollment. This is usually at least nine credit hours each term. For details: http://www.fis.ncsu.edu/grad_publicns/handbook/. However, to ensure that student can devote sufficient time to courses and other duties, the Graduate School limits the number of credit hours a TA or RA may register for to nine credit hours per term. A TA or RA who registers for more than the maximum number of credit hours allowed will be required to drop one or more courses unless special permission is granted. The maximum numbers of credits an assistant may complete during the terms of various appointments are given in the table below:

Maximum Course Loads – TA/RA Assistantship(s)

ASSISTANT CLASSIFICATION	LENGTH OF APPOINTMENT	MAXIMUM LOAD (credit-hours/term)
1/2 time	9 months	09 (12 with permission)
1/4 time	9 months	12

Advising

It is the responsibility of the student to locate a faculty advisor who can help the student develop a plan of work. The plan of work should be consistent with the goals of the student and satisfy the requirements of the department and graduate school. It is suggested that the student actively search for an appropriate advisor early in his/her graduate career. The faculty directory by research area on the departmental web page is a good place to start.

Registration Requirements & Continuous Registration*

After a student is admitted and enrolls for the first time, he/she is required to maintain continuous registration, i.e., be enrolled each semester, excluding summer sessions, until she/he has either graduated or her/his graduate program at NC State University has been terminated. The following exceptions may apply:

- A student in good academic standing who must interrupt his/her graduate program for good reasons must request a leave of absence from graduate study for a definite period of time. The leave absolutely may not exceed two semesters. The student should initiate the request with the Chair of his/her Advisory Committee and have it endorsed by his/her Director of Graduate Programs before submitting it to the Graduate School. The Graduate School should receive the request at least one month prior to the first day of the term involved.
- All students who take their Final Oral Examination or submit their thesis or dissertation to the Graduate School during either Summer Session must be registered for either the first or second Summer Session.
- Students, who complete all requirements for their degree *after* the deadline for a given semester, but *prior* to the first day of classes of the next, do not have to

register for the next semester. However, the degree will be awarded at the end of the next semester.

- Students are not required to be registered if their only remaining requirement for graduation is the removal of an incomplete (IN). However, students who do not remove any remaining IN grade(s) in the semester or summer following completion of all other requirements will be terminated at the end of that semester or summer due to non-compliance with the continuous registration policy.
- For students conducting research and/or who are in the process of preparing their theses, the following courses may be taken for credit to satisfy University and/or Departmental credit requirements and/or Residency requirements. Also, students who have completed essentially all their credit requirements, but must remain enrolled can take one of the appropriate courses listed below:

ECE 695 - Thesis Research: For M.S. students who will be devoting the appropriate amount of time to thesis research.

ECE 699 - Thesis Preparation: For M.S. students who have completed all course work (including any hours of ECE 695), research, and residence requirements, and are involved in writing their thesis. ECE 699 cannot be used toward the minimum 30-hour requirement for the M.S. degree. Only 3 hours of ECE699 is required for full-time enrollment status.

ECE 895 - Dissertation Research: For doctoral students who have passed the Qualifying Review, and are devoting a substantial portion of their time to research toward the dissertation.

ECE 899 - Thesis Preparation: For doctoral students who have completed all course work (including all required hours of ECE 895), research, residence requirements, and have passed the preliminary oral exam. ECE 899 may not be used toward the minimum requirements for the degree. Only 3 hours of ECE899 is required for full-time enrollment status..

- *Students who are not enrolled and are not granted a leave of absence will have their programs terminated.*

Academic Difficulty*

Each student is required to maintain a graduate GPA of at least 3.0. Graduate students will be placed on academic probation if they have accumulated more than 18 hours at the 400 level or above and have a GPA in the range of 2.67 to 2.99. Graduate students will be terminated from their program of study if they have accumulated more than 18 hours at the 400 level or above and have a GPA below 2.67, or if they have accumulated 30 or more hours and have less than a 3.00 GPA. In the case of program termination, no further registration in a graduate classification will be permitted. In extenuating circumstances, a student who has been terminated may be reinstated once. The student's advisor/advisory committee and the Director of Graduate Programs must endorse a recommendation for such reinstatement. The Dean of the Graduate School must then approve this. The committee/advisor recommendation must be written, must be unanimous, must justify the reinstatement, and must include a reasonable program or plan for raising the GPA to 3.0.

Degree Requirements

A concise table of the timeline and milestones for ECE degree programs is available via the ECE Graduate Program webpage, <http://www.ece.ncsu.edu/academics/grad>.

Minor in Electrical and Computer Engineering (ECE)

A minimum of 9 semester credit hours of graduate level (500/700) graded courses is required for a minor in ECE for MS Students; 12 credit hours are required for PhD students. MS Thesis and PHD students should have an ECE faculty member on their committee.

Master of Science (NCSU)*

A minimum of 30 semester credit hours is required for all Master's degrees; however, many programs require more than thirty. Also, many students, in order to gain the breadth desired in their programs or to make up deficits in their undergraduate degrees, will actually take more credit hours than the minimum required by their programs. The following rules are from the NCSU Graduate Administration Handbook, http://www.fis.ncsu.edu/grad_publicns/handbook/.

1. No more than two credit hours of departmental seminar may be included in the minimum 30-credit program.
2. No more than three credit hours of Master's supervised teaching (685) may be included in the minimum 30-credit program
3. Programs that require a thesis may include no more than six hours of Thesis Research credit (695) in the minimum 30-credit-hour program. Thesis Research credit is not appropriate in non-thesis programs.
4. Non-thesis programs may include no more than three hours of independent study credits in the minimum 30-credit program. *Note: NCSU allows six in other disciplines.*
5. ECE limits this to one 400 level course from outside ECE. *Note: The university limit is no more than ten hours of 400-level courses may be counted toward the minimal 30-hour requirement, and they may not come from the major field.*
6. Master's Thesis Preparation (699) credits may not be used to satisfy the 30-credit hour requirement.
7. Non-thesis Master's Examination (690) credits may not be used to satisfy the 30-credit hour requirement.
8. At least 18 hours of the minimum 30 hours required for the Master's degree must be graduate credits earned while the student is enrolled in a graduate classification at NC State.
9. At least 18 hours of the 30 hour requirement may not have been, and may not be, used to satisfy degree requirements for another Master's degree at NC State.
10. Also, at least 18 of the 30 hour requirement may not have been taken while the student was enrolled in another Master's degree program, unless the student did not complete the other program. In addition, students pursuing a Master's degree after having completed a doctoral degree at NC State must complete at least 18 graduate credit hours at NC State after enrollment in the Master's program.

11. The remaining 12 credit hours, or more depending on the requirements of the specific program, may be transferred from any of several sources. For details see the Graduate Administration Handbook.

Submitting Transfer Credit for Graduate School Approval

All requests for transfer credits must be done at the time of the submission of the Plan of Graduate Work. The Director of Graduate Programs will submit a letter requesting that any transfer credit be accepted as a part of the student's graduate program. An official transcript indicating the work to be transferred must accompany the letter.

Graduation*

Request for Review of Records for Graduation

Students *must request* a review of their records by the Graduate School in the semester during which they will complete all courses listed on their Plan of Graduate Work. M.S. students pursuing a thesis option program ("Option A") requests are due by the end of the sixth week of classes. For M.S. students pursuing a non-thesis option, ("Option B") requests must be submitted to the Graduate School within the first six (6) weeks of the semester the student is expecting to graduate and within (7) days of the beginning of the second summer session for summer graduates. The student's Plan of Graduate Work must be completed and updated if necessary prior to the semester the student plans to graduate. *These forms should be submitted to the ECE Graduate Office during the first five (5) weeks of the semester to allow for checking and computer submission. It is ECE departmental policy that Option B forms will not be submitted until the plan of work has been approved by the director of graduate programs.*

Submission of Request for Diploma

Students must submit a Request for Diploma in order to receive the diploma. All graduation paper work must be filled out at the beginning of the semester for which the degree is to be earned. This paperwork can be obtained from the Graduate Office. Each student who desires to graduate at the end of a given term should meet all deadlines for completion of work and submission of forms as posted on the Graduate Student Bulletin Board. For M.S. students pursuing a thesis option program (option A), the request is normally due to the Graduate School by the end of the fifth week of classes. For M.S. Students pursuing a non-thesis option (Option B), the request must be submitted to the graduate school during the first six (6) weeks of the semester. This includes the Request for Diploma form, which is available from the ECE Graduate Office. *These forms should be submitted to the ECE Graduate Office during the first five (5) weeks of the semester to allow for checking and computer submission.*

Commencement

Commencement ceremonies are held at the end of the fall and spring semesters. Ceremonies are held in December and May. All students who will have completed the requirements for the degree prior to the commencement ceremony are encouraged to participate. Each student who wishes to participate must inform the ECE Graduate Office at the time of the diploma request. Late requests may be denied. Summer graduates receive diplomas in December.

Late Diplomas

A student who has satisfied all degree requirements (including passing the final oral), but fails to meet the deadline for passing the final oral, submitting the thesis or dissertation, or submitting the Request for Diploma will receive the diploma late. A letter stating that all requirements for the degree have been met may be obtained from the Graduate School. The ECE Department is not authorized to write such letter.

MS Requirements (ECE)

Timing and Plan of Graduate Work

A Master of Science in CPE, CNE or EE may be obtained without a thesis (Option B). Each such student must formally select a non-thesis advisor by the end of his/her second semester's enrollment. Students failing to establish an advisor within the prescribed time limits may be prevented from registering, asked to withdraw from the program, lose any assistantships, or have their admission status revoked. A student may submit a written request to change his/her advisor at any time. Requests to appoint, or change the advisor are subject to the approval of the Current Advisor, the Director of Graduate Programs, and the Graduate School. An advisor must be either a regular or associate member of the ECE Graduate Faculty. Forms for advisor appointments and changes are available online via the ECE Graduate Program webpage, <http://www.ece.ncsu.edu/academics/grad>.

A formal **Plan of Graduate Work** must be submitted before the end of the second semester's enrollment. Students failing to establish a Plan of Graduate Work within the prescribed time limits may be prevented from registering, asked to withdraw from the program, or have their admission terminated. Forms for establishing the Plan of Graduate Work are available online via the ECE Graduate Program webpage. The Graduate Dean must approve the Plan of Graduate Work after departmental approval by the Director of Graduate Programs. Continuous registration is required (see Registration Requirements under General Information for details). The Plan of Graduate Work may be changed at any time subject to the approval of the advisor, the ECE Director of Graduate Programs, and the Graduate School. Forms for changing the Plan of Graduate Work may be obtained online via the ECE Graduate Program webpage, <http://www.ece.ncsu.edu/academics/grad>.

All EE and CPE Students

1. All graduate students must attend the ECE600 seminar (a one credit hour course) in either the first or second semester. This seminar deals with topics important for the graduate career of the student.
2. The MS degree requires at least 30 credit hours. The MS program requires both breadth and depth.
3. Breadth is obtained by at least one course from each of three (3) specialty areas in Table 1.
4. Depth is achieved by taking at least two **advanced graduate level** courses. Advanced courses are 700 level regularly scheduled ECE courses. Special topics courses, 79x, may not be counted as advanced. At least one of the advanced courses must come from the major track (EE or CPE). For thesis MS students, ECE695 counts as an advanced course.
5. The major, EE or CPE, is obtained by taking **five (5)** courses from major track from the entire list of courses in ECE. At least one of the advanced courses must come from the major track. Three hours of thesis can be credited as one course in the major. Only one course in the major track is subject to this substitution.
6. The student must take 21 hours of ECE courses, 18 hours must be graded, i.e., only one S/U course allowed, (ECE633, 634, 682), exclusive of ECE695. ECE695 cannot be used for credit by non-thesis students. The student must have a GPA of at least 3.000 in ECE courses. This includes courses cross-listed with other departments.
7. Maximum six(6) hours of ECE695 is allowed for MST students – an MST student may have up to nine hours of S/U, e.g., 6 hours ECE695 + 3 hours ECE633.
8. Up to nine hours of graduate-level (500,700) courses outside of ECE may be taken. At most one senior-level (400) course may be included in these nine hours. These courses must be part of a unified plan of study for an advanced ECE degree. These courses should be taken with prior approval of the director of graduate programs or the ECE Graduate Studies Committee.
(As a guideline, note that the common graduate-level, technical courses in CSC, MA, STAT, PHYS, CH, or any engineering department are acceptable. BUS courses that are listed for the CNE program are acceptable. Substitutions for BUS courses require prior approval. It is wise to check with the graduate office before taking courses outside of the above mentioned areas.)
9. Examples for plans of work for various areas can be found at <http://www.ece.ncsu.edu/academics/grad/plans/>.

TABLE 1: Specialty areas	
Specialty	Course Numbers
Computer Architecture (CPE)	ECE506(FS) ECE521(FS), ECE561(S), ECE721(FO), ECE743(V), ECE747(S), ECE705(V), ECE706(S), ECE785(F), ECE786(S)
Software (CPE)	ECE 517(F), ECE 566(S)
VLSI Systems (CPE)	ECE 520(S), ECE546(F), ECE 704(V), ECE 741(V), ECE745(F), ECE761(S)
Networking(CPE)	ECE 570(FS), ECE573(FS), ECE574(FS), ECE575(S), ECE 576(FS), ECE579(FS), ECE773(S), ECE774(S), ECE775(F), ECE 776(S), ECE 777(F), ECE779(S)
Circuits (EE)	ECE 511(F), ECE703(F), ECE 712 (S), ECE718(S), ECE 733(S)
Microwave Circuits and Applied Electromagnetics (EE)	ECE 540(S), ECE549(F), ECE719(F), ECE732(S)
Communications (EE)	ECE515(S), ECE582 (F), ECE 751(SO), ECE752(SO), ECE 762(F), ECE766(S), ECE767(SE)
Signal Processing and Computational Intelligence (EE)	ECE 513(F), ECE559(SE), ECE742 (S), ECE763(F)
Robotics, Mechatronics, Control & Instrumentation (EE)	ECE 516(S), ECE522(F), ECE555(S), ECE556(F), ECE 726(V), ECE755(F)
Power Electronics and Power Systems (EE)	ECE 534 (F), ECE550 (FE), ECE553 (S), ECE734 (S), ECE 736(F), ECE753(SE), ECE792P* (SO), ECE792S* (SE), * these course may count as advanced, pending CAF
Nanoelectronics and Photonics (EE)	ECE523(S), ECE 530**(F), ECE531(F), ECE538(F), ECE557(F), ECE 722(F), ECE 723(SO), ECE 724(S) ** Required for students majoring in nanoelectronics and photonics.
Key to course offerings: F- fall, S – spring, FS – both fall and spring, FO – fall odd years, FE – fall even years, SO – spring odd years, SE – spring even years, V – variable, depending on instructor availability, Sum – summer, for courses that have an inconsistent history, we have noted the last time it was offered.	

All CNE Students:

The following information is taken from the Computer Networking website: <http://networking.ncsu.edu/> . Additional information and details can be found there.

A minimum of 30 credit hours is required for all students. The Computer Networking core courses constitute 9 of these 30 credit hours. Students must take 12 credit hours of additional computer networking courses from one of four technical concentration areas. Each technical concentration area includes both required and elective courses.

The remaining 9 credit hours may be taken from either

- An approved management concentration sequence
- Additional courses from the Computer Networking technical concentration areas
- Pool of graduate level CSC courses

- Pool of graduate level ECE courses that form the CPE major (refer to the ECE graduate student handbook)

The above is the only way of earning the 9 credits for students pursuing the MS without-thesis option. Students earning the MS with a thesis option may substitute a maximum of six credit hours of the 9 with thesis work (ECE or CSC 695) *At least 6 of the 30 credits must come from the 700-level. Individual study courses cannot account for more than 3 credit hours.*

Core Course Requirements : All students must take the following three core courses for a total of 9 credit hours: CSC/ECE 570: Computer Networks, CSC/ECE 579: Computer Performance Modeling, and one BUS course from the approved list.

Technical Concentrations: All students must earn 12 credits by taking four courses from one of the defined technical concentration areas for the MS Computer Networking degree. Each technical concentration has a set of courses that are required for students electing that concentration. The number of required courses may vary, depending on the concentration area chosen. The technical concentration areas are **Network Design**, **Network Hardware** and **Network Software**.

For the remaining 9 hours of credit: Students in the MS without-thesis program (Option B) can either take three approved electives chosen from any of the approved technical or management concentration areas, or earn a **Management Concentration** by completing a three-course sequence in management from the approved list for the MS Computer Networking degree. Students pursuing the MS with thesis option (Option A) may use a maximum of six credit hours of the remaining 9 hours for thesis research.

Application to Ph.D. Program

A non-thesis M.S. student who wishes to apply for admission to the Ph.D. program should ask his/her advisor **and** one additional ECE graduate faculty member to complete a Recommendation for Admission during the final semester of the MS degree program and submit the request to the ECE Graduate Office. The form is available online via the ECE Graduate Program webpage, <http://www.ece.ncsu.edu/academics/grad>.

Notes on MS Thesis Option

A student who wishes to pursue the MS with thesis option is permitted to do so if a member of the ECE Graduate Faculty agrees to serve as the student's advisory committee chair and to direct the student's thesis research. A student who enters the program under the non-thesis (Option B) option may change to the thesis option if a faculty member agrees to serve as the student's advisory committee chair and to direct the student's thesis research.

A graduate student pursuing a Masters with Thesis will not be allowed to change to a Masters without thesis without approval from both the student's advisor and the Director

of Graduate Programs. Approvals will only be rarely granted and must be justified in writing. Only if the Chair of the student's committee becomes unable or unwilling to direct the work to completion, and the student is unable to find another graduate faculty member willing to direct the work, will the student be approved to transfer to the non-thesis option.

Advisory Committee

Each MS with thesis student must form a Graduate Advisory Committee by the end of the semester in which 12 or more credits are completed toward the degree sought. Contact the ECE Graduate Office for the form for establishing a Graduate Advisory Committee. Students failing to establish a committee within the prescribed time limits may have their admission terminated. The Advisory Committee consists of two representatives from the student's elected major (EE, CNE or CPE), and a graduate faculty member from outside the major. The intent of this rule is to add breath to the committee. The member from outside the major area can be from a different department or be from ECE but have as his/her major interest in an area different from that of the student. The Director of Graduate Programs may determine if a faculty is from outside the major area. Major representation may be either Regular Members of the major, or Associate Members (Associate members are faculty members in other departments who hold Associate status in ECE). However, the number of Associate Members may not exceed the number of Regular Members.

The following is from the NCSU Graduate Administration Handbook,
http://www.fis.ncsu.edu/grad_publicns/handbook/.

Membership*

All required members of the Advisory Committee must be members of the NCSU Graduate Faculty. Others may serve only in an ex-officio capacity, and must be identified as such on the appointment form. A vita for ex-officio members must be attached to the appointment form. A student may submit a written request to change the membership of his/her advisory committee at any time. The request is subject to the approval of the Committee Chair, the Director of Graduate Programs, and the Graduate School. If a minor is elected, a minor representative on the committee is required. Only one representative is required for regular or interdisciplinary minors. There must be a representative from each component of a split minor.

Final Oral Examination*

Each MS student electing the thesis option must submit to a Final Oral Examination conducted by the student's Graduate Advisory Committee. Unanimous approval by the Advisory Committee is required for passing the examination. Such approval may be conditioned on satisfactory completion of additional work. Failure of the examination terminates the student's graduate study unless the student's Graduate Advisory Committee unanimously recommends re-examination. Only one re-examination is permitted and at least

three full weeks must elapse before such a re-examination is held. The Final Oral Examination may be held no earlier than the semester during which the student will complete all courses on his or her Plan of Graduate Work. The examination must be held before the Graduate School's Deadline for Final Oral Examinations if the degree is to be awarded at the end of the semester in which the examination is given.

Scheduling*

The Final Oral Examination is scheduled only at the request of the student and upon the approval of his or her Advisory Committee. A student may not submit a request to schedule the examination until the Graduate School has approved his/her Plan of Graduate Work. Copies of the thesis must be distributed to the members of the Advisory Committee and the ECE Graduate Office at least two weeks prior to the exam. The student must be in good academic standing when the request is submitted and when the examination is held. *The request must be submitted to the ECE Graduate Office at least 3 weeks prior to the date of the examination.* If a committee member cannot attend a scheduled examination, the Graduate School must approve a substitute prior to the examination. It is the responsibility of the chair of the committee to obtain a substitute and the required permission.

Conduct of Final Oral Exams*

The Chair of the Graduate Advisory Committee has an obligation to maintain a scholarly atmosphere and to keep the student's best interest foremost. The student is expected to defend the methodology used and the conclusions reached in the research as reported in the thesis. It is the Chair's option to allow visitors to ask questions of the candidate during the presentation. Any Graduate Faculty Member in attendance must be allowed to express his or her opinions to the committee in the absence of the student, but the final deliberations and the vote are private to the Graduate Advisory Committee. A unanimous vote of approval is required for passing, although approval may be conditioned on the student's meeting additional requirements, specified in writing by the committee at the time of the examination. Failure to pass the examination terminates the student's work at this institution unless the Graduate Advisory Committee recommends a re-examination. Only one re-examination is permitted and at least 3 weeks must elapse from the date of the initial examination before the examination can be rescheduled.

Normal Practice*

While it is entirely up to the Chair as to how to conduct the exam, within the requirements set forth above, the following practice is normally used. As a convenience, the Chair normally has the student's entire folder, obtained from the Graduate Office, so that the Graduate Advisory Committee members may review pertinent data. The Graduate Advisory Committee may or may not meet in private session for a short time immediately before the student enters to be examined, as deemed necessary by any committee member. Introductions and

any special considerations may be discussed during this time. The student and visitors then enter, and the Committee, with the Chair of the Graduate Advisory Committee moderating, examines the student. The Chair should announce his/her decision as to whether to allow visitor questions during the examination. When the examination is concluded, the Chair should ask those present for further questions/comments. Then he/she should ask all non-Graduate Faculty Members to leave, and invite comments from any non-committee Graduate Faculty who are in attendance. After non-committee Graduate Faculty comments have been received, the Chair should meet with the Graduate Advisory Committee in private session for final deliberations and then vote. The student is then invited to return and the Chair advises the student of the Graduate Advisory Committee's decision. Thesis signature sheets are normally available for signature at this time for signature by the Graduate Advisory Committee.

Application to Ph.D. Program (ECE only)

A master of science with thesis (MST) student who wishes to apply for admission to the Ph.D. program should ask his/her advisor and one additional ECE Graduate Faculty Member to complete a Recommendation for Admission during the final semester of the MS degree program. The request should be submitted to the ECE Graduate Office.

Submission of Thesis*

Upon passing the MS Final Oral Examination, each MS thesis student must have the thesis approved by each member of the student's Advisory Committee. The thesis must be submitted to the Graduate School by the deadline given in the academic calendar, and must conform to the Guide For Preparation of Theses.

Ph.D. Degree

The department offers the Ph.D. degree in either Electrical Engineering or Computer Engineering. The information below applies to either track.

Graduate students who have entered the PhD program, who already have a Masters degree prior to entering NCSU, and who have been receiving financial aid in the form of a research assistantship may not be approved for a change from a PhD to a Masters degree. Students changing from PhD to Masters will also be limited to a total of two semesters of financial aid through a teaching assistantship. A student in this category must convince the Director of Graduate Programs that they cannot find any faculty member who will supervise their research or they can obtain no financial support via a research assistantship.

Credit-Hour Guidelines*

A typical full-time PhD Graduate Student registers for at least nine credit hours per semester. The student and his Graduate Advisor develop a Plan of Graduate Work leading to the PhD. This Plan must be submitted to the Graduate Office before the end of the second semester and requires the approval of the Director of Graduate Programs. The student's Graduate Advisory Committee determines the

number of courses required for the Ph. D. program through the development of the Plan of Graduate Work. It is a requirement of the university that the Plan of Work account for at least 72 credit hours past the baccalaureate degree. The Director of Graduate Programs must approve the Plan of Graduate Work.

ECE Course Requirements for the PhD Degree

1. All PhD students are required to complete, with a grade of B+ or better, at least one course from each of three ECE specialty areas, as defined by the table in the MS Requirements section (page 11). These courses must be taken at NC State. Courses taken during the MS may be used to satisfy this requirement. These course should be taken prior to or concurrent with semester of the qualifying review.
2. A minimum of 42 hours of graded coursework past the BS degree is required, or a minimum of 18 hours past the MS degree. Since the PhD degree is more advanced than the MS degree, the total PhD plan must exceed all requirements for an MS degree at NC State.
3. A minimum of 36 hours of graded graduate-level ECE courses should be included in the total PhD career. At least 12 of these ECE course hours must be taken at NC State. Courses taken during the MS may be used to satisfy this requirement. An MS degree in ECE from another university counts as 18 hours toward this requirement.
4. Breadth at the PhD level is beneficial to the student and is required. All PhD students must take at least 9 hours of graded coursework outside the major track (defined as EE or CPE) – see Appendix A. Note that a course that is listed in both tracks cannot be used as outside the major track. Courses outside the ECE Department also qualify as outside the major track. Three of these nine credit hours may be at the 400 level, if they are outside the Department and are not needed as a prerequisite for a course inside the Department. Six credit hours must be at the 500 level or above. Courses taken during the MS degree may be used to satisfy this requirement. (Courses from other universities must be approved by the Director of Graduate Studies.) A formal minor may be used to meet this requirement, but it is not required. The requirements of the minor, if elected, will be determined by the Committee Representative in the minor area, in conjunction with the remainder of the committee.
5. All graduate students in ECE must attend the ECE600 seminar in either their first or second semester at NCSU.

A table of example cases is shown in Appendix B.

Credits from Outside Sources*

Transfer credits or credits from extension courses are not acceptable for credit toward the Ph.D. degree. Credits obtained in regular graduate courses through PBS at NCSU may be accepted in certain circumstances to satisfy the overall credit hour requirements for the degree.

Dissertation Research*

The emphasis for the PhD is on original research. Therefore, there is no limit as to the number of credit hours that can be applied toward the PhD in the form of Dissertation Research Credits.

Residence Requirements for Ph.D. Students*

Each Ph.D. student must be registered at NCSU for graduate work, and must secure at least two residence credits through registration in continuous *semesters*. VBEE courses do not satisfy residency requirements. Residence credit is determined by the number of semester hours completed during a regular semester, according to the table below:

Residence Credits	
Semester Credits	Residence Credits
9 or more	1
6 to 8	2/3
0 to 5	1/3

Graduate Advisory Committee

A full-time student must establish a Graduate Advisory Committee before the completion of the second semester following admission. Students who are employed full-time, and enrolled on a part-time basis may add two semesters to the time required to form a committee. A written statement from the employer may be required. The formation of a Graduate Advisory Committee is a critical step in the progression toward completion of the degree. No progress toward a degree can be assured until after the committee has been formed. Establishment of the committee must be done formally using the form obtained from the ECE Graduate Office. **It is the student's responsibility to establish a Graduate Advisory Committee within the time limits specified above, and students should begin to explore faculty for membership on their committee early in their program.** Students are advised that faculty serve on advisory committees at the individual faculty member's discretion. Students failing to establish a committee within the prescribed time limits may not be permitted to register for classes may be asked to withdraw from the program or may have their admission revoked.

Membership of the Graduate Advisory Committee

All required members of a student's Graduate Advisory Committee must be members of the NCSU Graduate Faculty. Others may serve only in an ex-officio capacity, and must be identified as such on the appointment form. A vita for ex-

officio members must be attached to the appointment form. A student may submit a written request to change the membership of his/her Graduate Advisory Committee at any time to the Director of Graduate Programs, except that no changes to the committee may be made from the time the request for the Qualifying Review has been made until completion of the Qualifying Review. In addition, a request for a change in the Graduate Advisory Committee after the student has passed the Preliminary Oral Exam requires strong justification. All requests for change in the composition of the Graduate Advisory Committee are subject to the approval of the Committee Chair, the Director of Graduate Programs, and the Graduate School.

The Graduate Advisory Committee for a Ph. D. student has two membership forms. A committee may consist of a Chair and at least two other members from the ECE Graduate Faculty, and a representative from outside the Department (a minor representative, if elected). Alternatively, the committee may have a chair, at least three members from the ECE Graduate Faculty, and a Graduate School representative. The graduate Graduate School representative is appointed by the Graduate School at the time of the preliminary oral examination.

Either the Chair must be a full member of the Graduate Faculty or a full member must serve as a Co-Chair. Major representatives may be either Regular Members of the major or Associate/Inter-institutional Members. However, the number of Associated/inter-institutional Members may not exceed the number of Regular Members. A list of the EE and CPE graduate faculties is available in the Graduate Office. The Graduate School will appoint, if desired by the Committee Chair, a fifth member, the Graduate School Representative. The Graduate School Representative attends the Preliminary and Final Oral Examinations, and must sign the reports of those examinations, but does not otherwise participate in directing the student's work. As stated above, each student must have at least one representative from outside the ECE Department. If a minor is elected, a minor representative on the committee is required, and this member may satisfy the need for a representative from outside the department. Only one representative is required for a regular or interdisciplinary minor. There must be a representative from each component of a split minor.

Plan of Graduate Work

All graduate students must submit a Plan of Graduate Work to the ECE Graduate Office no later than the end of the second semester. The form for the Plan of Graduate Work may be obtained at <http://www.ece.ncsu.edu/academics/grad/forms/>. The Graduate School must approve the Graduate Advisory Committee at the time the Plan of Graduate Work is submitted. Forms for establishing and changing Plans of Work may be obtained in the ECE Graduate Office. Students failing to establish a Plan of Graduate Work within the prescribed time limits may not be permitted to or they may have their admission terminated.

Qualifying Review

PhD students must request a Qualifying Review by his/her ECE Graduate Advisory Committee Members no later than their third semester of enrollment. The student should be enrolled in the qualifying review course (ECE834) during the semester in which the qualifying review takes place. The ECE Committee Members will meet and review the student's potential to succeed in the Ph.D. program. Key factors considered include: the student's academic performance while enrolled in the Ph.D. program, potential to perform at a high academic level throughout the remainder of his/her study, potential to conduct high-quality research, and the student's ability to communicate both verbally and in writing.

The student's Graduate Advisory Committee will decide the exact nature of the Qualifying Review, which serves the purpose of the qualifying exam given in many universities. Such exams usually test the student's general background in ECE and in-depth knowledge in his/her chosen specialty. In the ECE department at NCSU, we have determined to measure the student's breadth of knowledge by his/her performance in at least three graduate level courses that are outside the student's specialty. This is reflected in the course requirements for the degree. The qualifying review is used to determine the in-depth knowledge.

The Qualifying Review may take many forms, including a formal written exam. However, it must have both oral and written components. At the conclusion of this review, the committee will recommend, by majority vote, for or against allowing the student to continue in the Ph.D. program. The written component should be submitted to the Graduate Office to be entered into the student's file. Students failing to obtain a majority recommendation to continue will be asked to withdraw from the program after the third semester. No student will be allowed to enroll for a fourth semester without a favorable Qualifying Review. Failure to withdraw will result in termination of admission to the program. Students in good standing who entered the Ph.D. program without having completed a master's degree may elect to transfer to the M.S. program for a terminal M.S. degree if they have completed less than six semesters at NCSU.

Part-Time Students

Students who are employed full-time may add two semesters to the time required to complete the core course work and to receive committee approval to continue in the program. A written statement from the employer may be required.

Timing for Students Entering Without an M.S. degree

Students who enter the program without an M.S. degree may request that the Qualifying Review be delayed to their fourth semester on recommendation of their Graduate Advisory Committee.

Preliminary Written Examination

Each Ph.D. student is required to pass a Preliminary Written Examination conducted by the student's Graduate Advisory Committee. A copy of the written

report must be provided to the Graduate Office for inclusion in the student's folder along with the committee's recommendation. The student's Graduate Advisory Committee determines the requirements for the Preliminary Written Examination and any re-examinations. In any event, at least one full semester must elapse before any re-examination is held

Timing*

The Preliminary Written Examination may not be held until the student has passed the Qualifying Review. It can be held no earlier than the end (final examination week) of the first year of graduate study and no later than one semester (four calendar months) prior to the Ph.D. final oral examination.

Scheduling

Students should consult with their Committee Chair (after passing the Qualifying Review) regarding scheduling of the Preliminary Written Examination.

Preliminary Oral Examination*

After completion of the Preliminary Written Examination, each Ph.D. student must submit to a Preliminary Oral Examination conducted by the student's Graduate Advisory Committee, including the Graduate School Representative, if one is required. If a committee member cannot attend a scheduled preliminary oral, a substitute approved by the Graduate School prior to the examination must be used. It is the responsibility of the chair to obtain a substitute and the required permission. No examination may be held unless all committee members are present or represented by an approved substitute. Unanimous approval by the Graduate Advisory Committee is required to pass the examination. Such approval may be conditioned on satisfactory completion of additional work.

Timing*

The Oral Examination may be held no earlier than the end (final exam week) of the second year of graduate study and no later than one semester (or four months) prior to the Ph.D. final oral examination.

Scheduling*

The Preliminary Oral Examination is scheduled only at the request of the student and only upon the approval of his/her Graduate Advisory Committee. A student may not submit a request to schedule an Oral Examination until the Graduate School has approved the student's Plan of Graduate Work and the student has passed the Preliminary Written Examination. The student must be in good academic standing when the request is submitted, and when the examination is held. The request must be submitted to the ECE Graduate Office as soon as possible, but at least three weeks prior to the date of the examination.

Conduct of Ph.D. Preliminary Oral Exams*

The Chair of the Graduate Advisory Committee has an obligation to maintain a scholarly atmosphere and to keep the student's best interest foremost. The student

is expected to defend the methodology used and the conclusions reached in the research as reported in the dissertation. It is the Chair's option to allow visitors to ask questions of the candidate. Any Graduate Faculty in attendance must be allowed to express their opinions to the committee in the absence of the student, but the final deliberations and the vote are private to the advisory committee. A unanimous vote of approval is required for passing, although approval may be conditioned on the student's meeting additional requirements specified in writing by the committee at the time of the examination. Failure to pass terminates the student's work at this institution unless the examining committee recommends a reexamination. Only one re-examination is permitted, and at least one full semester must elapse before the re-examination can be scheduled.

Normal Practice*

While it is entirely up to the Chair to conduct the exam within the requirements above, the following practice is normally used. The Advisory Committee may meet in private session for a short time immediately before the student enters to be examined, if necessary. Introductions and any special considerations may be discussed during this time. The student and visitors then enter and the student is examined with the Chair of the Advisory Committee in charge. The Chair should announce his/her decision on allowance of visitor's questions. When the examination is concluded and all questions have been asked, the Chair should ask the student and all non-graduate faculty members to leave, and invite comments from any non-committee graduate faculty who are in attendance. After non-committee graduate faculty comments have been received, the Chair should meet with the Graduate Advisory Committee in private for final deliberations and vote. The student is then invited to return and the Chair advises the student of the Advisory Committee's decision.

As a convenience, the Chair normally has the student's entire folder from the Graduate Office so that the Advisory Committee members may review pertinent data.

Advancement to Candidacy*

Although a student's university classification is 'Dr' when accepted into the program, a student is only admitted to candidacy for the Ph.D. degree upon passing the Preliminary Oral Examination.

Final Oral Examination*

Each Ph.D. student must submit to a Final Oral Examination conducted by the student's Graduate Advisory Committee, including the Graduate School Representative, if one is required. If a committee member cannot attend a scheduled Final Oral Examination, a substitute approved by the Graduate School prior to the examination must be used. It is the responsibility of the chair to obtain a substitute and the required permission. Failure of the examination terminates the student's graduate study unless the student's Graduate Advisory Committee unanimously recommends re-examination. Only one re-examination is permitted and at least one full semester must elapse before the re-examination

can be scheduled. The final examination may be held no earlier than four months after admission to candidacy. The examination must be held at least four weeks before the end of the semester or prior to the time designated by the Graduate School, if the degree is to be awarded at the end of that semester. Otherwise the degree will not be awarded until the end of the following semester.

Scheduling*

The examination is scheduled only upon the request of the student and the approval of his/her Graduate Advisory Committee. The dissertation must be completed and the preliminary copies of it must be distributed to the members of the student's Graduate Advisory Committee before the request to schedule the Final Examination is submitted to the ECE Graduate Office. The request must be submitted to the ECE Graduate Office at least three weeks prior to the date of the examination.

Conduct of Ph.D. Final Oral Exams*

The Chair of the Graduate Advisory Committee has an obligation to maintain a scholarly atmosphere and to keep the student's best interests foremost. The student is expected to defend the methodology used and the conclusions reached in the research as reported in the dissertation. It is the Chair's option to allow visitors to ask questions of the candidate. Any Graduate Faculty in attendance must be allowed to express their opinions to the committee in the absence of the student, but the final deliberations and the vote are private to the Advisory Committee. A unanimous vote of approval is required for passing, although approval may be conditioned on the student's meeting additional requirements specified in writing by the committee at the time of the examination. Failure to pass terminates the student's work at this institution unless the examining committee recommends a re-examination. Only one re-examination is permitted and at least one full semester must elapse before the re-examination can be scheduled.

Normal Practice*

While it is entirely up to the Chair to conduct the exam within the requirements above, the following practice is normally used. The Advisory Committee meets in private session for a short time immediately before the student enters to be examined. Introductions and any special considerations may be discussed during this time. The student and visitors then enter and the student is examined with the Chair of the Advisory Committee in charge. The Chair should announce his/her decision on allowance of visitor's questions. When the examination is concluded, the Chair should ask all visitors and non-Graduate Faculty to leave, and invite comments from any non-committee Graduate Faculty who are in attendance. After non-committee Graduate Faculty comments have been received, the Chair should meet with the Advisory Committee in private for final deliberations and vote. The student is then invited to return and the Chair advises the student of the Advisory Committee's decision. As a convenience, the Chair normally has the student's entire folder from the Graduate Office so that Graduate Advisory

Committee members may review pertinent data. Dissertation signature sheets are normally available for signature.

Submission of Theses and Dissertations*

Upon passing the Ph.D. Final Oral Examination, each Ph.D. student must have the dissertation approved by each member of the student's Graduate Advisory Committee. The dissertation must be submitted to the Graduate School (by appointment only) by the deadline given in the academic calendar, and must conform to the Guide for Preparation of Theses and Dissertations.

APPENDIX A (revised 2/08)				
CONSULT TRACS FOR COURSE AVAILABILITY THIS TERM				
ECE COURSE MAJOR ASSOCIATION				
			MAJOR	
COURSE NO.		EE	CpE	COURSE TITLE
ECE	506		X	ARCHITECTURE OF PARALLEL COMPUTERS
ECE	511	X		ANALOG ELECTRONICS
ECE	513	X		DIGITAL SIGNAL PROCESSING
ECE	514	X		RANDOM PROCESSES
ECE	515	X		DIGITAL COMMUNICATIONS
ECE	516	X		SYSTEM CONTROL ENGINEERING
ECE(CSC)	517		X	OBJECT-ORIENTED LANGUAGE & SYSTEMS
ECE	520		X	DIGITAL ASIC DESIGN
ECE	521		X	DIGITAL COMPUTER TECHNOLOGY AND DESIGN
ECE(BME)	522	X		MEDICAL INSTRUMENTATION
ECE	523	X		PHOTONICS AND OPTICAL COMMUNICATIONS
ECE	528	X		SEMICONDUCTOR CHARACTERIZATION
ECE	530	X		PHYSICAL ELECTRONICS
ECE	531	X		PRINCIPLES OF TRANSISTOR DEVICES
ECE	532	X		PRINCIPLES OF MICROWAVE CIRCUITS
ECE	534	X		POWER ELECTRONICS
ECE(MAE)	535	X		DESIGN OF ELECTROMECHANICAL SYSTEMS
ECE	538	X		INTEGRATED CKT TECHNOLOGY AND FABRICATION
ECE	540	X		ELECTROMAGNETIC FIELDS
ECE	546	X	X	VLSI SYSTEMS DESIGN (NOTE CROSSLISTING)
ECE	549	X		RF WIRELESS DESIGN
ECE	550	X		POWER SYSTEM OPERATION AND CONTROL
ECE	553	X		SEMICONDUCTOR POWER DEVICES
ECE	555	X		COMPUTER CONTROL OF ROBOTS
ECE	556	X		AGENT-BASED MECHATRONICS SYSTEMS
ECE	557	X		PRINCIPLES OF MOS TRANSISTORS
ECE	561		X	EMBEDDED SYSTEM DESIGN
ECE	566		X	COMPILER OPTIMIZATION AND SCHEDULING
ECE(CSC)	570		X	COMPUTER NETWORKS
ECE(CSC)	573		X	INTERNETWORK PROTOCOLS AND ARCHITECTURE
ECE(CSC)	574		X	NETWORK SECURITY
ECE(CSC)	575		X	INTRODUCTION TO WIRELESS NETWORKING
ECE(CSC)	576		X	CONNECTION-ORIENTED NETWORKS
ECE	579		X	INTRO TO COMPUTER PERFORMANCE MODELLING
ECE	582	X		WIRELESS COMMUNICATION SYSTEMS
ECE	600	X	X	ORIENTATION COURSE
ECE	703	X		INSTRUMENTATION CIRCUITS
ECE	704		X	LOGIC DESIGN FOR TESTABILITY
ECE	705		X	MEMORY SYSTEMS

APPENDIX A (revised 2/08)					
ECE	706			X	ADVANCED PARALLEL COMPUTER ARCHITECTURE
ECE	712		X		INTEGRATED CIRCUIT DESIGN FOR WIRELESS COMMUNICATION
ECE(MAE)	717		X		MULTIVARIABLE SYSTEMS THEORY
ECE	718		X		COMPUTER-AIDED CIRCUIT ANALYSIS
ECE	719		X		MICROWAVE CIRCUIT DESIGN
ECE	721			X	ADVANCED MICROARCHITECTURE
ECE	722		X		ELECTRONIC PROPERTIES OF SOLID STATE MATERIALS
ECE	723		X		OPTICAL PROPERTIES OF SEMICONDUCTORS
ECE	724		X		ELECTRONIC PROPERTIES OF SOLID STATE DEVICES
ECE	725		X		QUANTUM ENGINEERING
ECE	726		X		ADVANCED FEEDBACK CONTROL
ECE	727		X		SEMICONDUCTOR THIN FILM TECHNOLOGY
ECE	729		X		GROWTH OF THIN FILMS FROM THE VAPOR PHASE
ECE	733		X		DIGITAL ELECTRONICS
ECE	734		X		POWER MANAGEMENT INTEGRATED CIRCUITS
ECE	736		X		POWER SYSTEM STABILITY AND CONTROL
ECE	737		X		MICROWAVE DEV. CHARACTER. TECHNIQUES
ECE	739		X		INTEGRATED CKT TECHNOLOGY FABRICATION LAB.
ECE	741			X	SEQUENTIAL MACHINES
ECE	742		X		ARTIFICIAL NEURAL NETWORKS
ECE	743			X	HIGH PERFORMANCE MULTICOMPUTER ARCHITECTURE
ECE	744		X		DESIGN OF ELECTRONIC PACKAG. & INTERCONNECTS
ECE	745			X	ASIC VERIFICATION
ECE	746			X	HIGH PERFORMANCE VLSI DESIGN
ECE	747			X	DIGITAL SIGNAL PROCESSING ARCHITECTURE
ECE	751		X		DETECTION AND ESTIMATION THEORY
ECE	752		X		INFORMATION THEORY
ECE	753		X		COMPUTER ANAL. OF LARGE SCALE POWER SYSTEMS
ECE	755		X		ADVANCED ROBOTICS
ECE	756		X		ADVANCED MECHATRONICS
ECE	759		X		PATTERN RECOGNITION
ECE	761			X	DESIGN AUTOMATION FOR VLSI
ECE	762		X		ADVANCED DIGITAL COMMUNICATIONS SYSTEMS
ECE	763		X		COMPUTER VISION
ECE	764		X		DIGITAL IMAGE PROCESSING
ECE	765			X	FAULT TOLERANT COMPUTING
ECE	766		X		WIRELESS COMMUNICATIONS: SIGNAL PROCESSING PRINCIPLES
ECE	767		X		ERROR-CONTROL CODING
ECE(CSC)	773			X	ADVANCED TOPICS IN INTERNET PROTOCOLS
ECE(CSC)	774			X	ADVANCED NETWORK SECURITY
ECE(CSC)	775			X	ADVANCED WIRELESS NETWORKS
ECE(CSC)	776			X	DESIGN & PERFORMANCE EVALUATION OF NETWORK SYSTEMS & SERVICES
ECE(CSC)	777			X	TELECOMMUNICATIONS NETWORK DESIGN
ECE	778		X		OPTICAL FIBER COMMUNICATIONS
ECE(CSC)	779			X	ADVANCED COMPUTER PERFORMANCE MODELLING
ECE	781		X	X	SPECIAL STUDIES IN ECE GIVEN AS NEED ARISES

APPENDIX A (revised 2/08)					
ECE	782		X	X	SPECIAL STUDIES IN ECE GIVEN AS NEED ARISES
ECE	785			X	ADVANCED COMPUTER DESIGN
ECE	786			X	ADVANCED COMPUTER ARCHITECTURE
ECE	791		X	X	SPECIAL TOPICS IN ECE (DEPENDS ON TOPIC)
ECE	792		X	X	SPECIAL TOPICS IN ECE (DEPENDS ON TOPIC)
ECE	633		X	X	INDIVIDUAL TOPICS IN ECE (MS Level)
ECE	634		X	X	INDIVIDUAL STUDIES IN ECE LIMITED TO TWO COURSES (MS Level)
ECE	833		X	X	INDIVIDUAL TOPICS IN ECE (PHD Level)
ECE	834		X	X	INDIVIDUAL STUDIES IN ECE FOR QUALIFYING REVIEW (PHD Level)

Appendix B

A table of the graded coursework for several common situations is given below

ECE PHD Graded Course Requirements (Proposed)					
	Direct from BS	NCSU MSN 30 hours of ECE courses	NCSU MSN 21 hours of ECE courses, 9 hours outside ECE	NCSU MST 21 hours of ECE courses, 9 hours thesis, special topics	Other MS in ECE – 18 hours credit
Total Minimum Graded Hours in PHD after last degree	42	12	12-18 (depends on 9 hours)	18	18
Minimum Graded ECE courses at NCSU after last degree	36	6	15	12	12
Graded Graduate level courses outside major area at NCSU	9	9	9	9	9 *
Courses in three ECE specialty areas at NCSU with B+ or better	Yes	Can count those during MS	Can count those during MS	Can count those during MS	Must take at NCSU

* Students with MS degrees from other universities in subjects other than ECE may count their MS courses toward this requirement. However, these students are required to take appropriate courses to satisfy ECE graduate admission requirements and pass the courses in three specialty areas. Courses taken outside of ECE at other U.S. universities require approval of the Director of Graduate Programs. Detailed documentation of course content is required.

ECE Milestones

(see university deadlines in graduate administration handbook

http://www.fis.ncsu.edu/grad_publicns/handbook/)

Required Forms/Actions*	When Required	Who Initiates	Comments
Complete, official transcripts from universities and colleges attended, including degrees and dates awarded	Before the beginning of the first semester of enrollment	Student is responsible for providing official transcripts to the Graduate School.	You cannot graduate without an official transcript on file with the NCSU Graduate School
Plan of Work (PhD and MS)	By the end of the second semester of enrollment (or the semester in which you complete 18 hours)	Student is responsible for submission of plan to ECE grad office. DGP is responsible for assuring the plan meets ECE requirements.	Forms for Plan of Work for the various degree programs are available via the ECE grad web page.
Request for appointment of advisory committee for MS Thesis or PhD	With Plan of Work	Student must find an advisor (chair of committee). Committee is checked by DGP and submitted to the NCSU Graduate School.	Form is available in Plan of work file via ECE web page. Check rules for committees in ECE Grad Student Handbook
Modification of Plan of Work	No later than four (4) weeks into the semester in which you plan to graduate.	DGP is responsible for assuring the plan meets ECE requirements. Student is responsible for assuring that plan of work matches transcript.	Form is available in Plan of work file via ECE web page. If no plan has been filed, you may not graduate that semester. Late filing may delay graduation.
Signature of Patent Agreement , or patent exemption agreement	No later than the end of the first semester of enrollment	Initiated by student and submitted to the Graduate School by the ECE graduate office.	Form is available in Plan of work file via ECE web page.

Request for Option B Graduation Checkout for master's students in Option B (non-thesis) program only	No later than the fourth week (4 th) of the semester in which the student plans to graduate (7 working days after the first day of SS I for summer graduates)	Initiated by the student and submitted to the ECE DGP. ECE Grad Office submits to NCSU Graduate School.	The Graduate School may take up to 15 working days to respond to the request.
Diploma Order Request Card	By the end of the fourth (4 th) week of classes of the semester in which the student plans to graduate.	Initiated by student (cards available in departments and Graduate School Records Office).	Non-thesis MS student submit with Option B checkout form. If you cannot graduate due to any circumstances, please inform the ECE Grad Office.
Request for a Permit to Schedule the Master's Oral Examination (master's students only)	Submit to ECE Grad Office 15 days before exam date. The ECE Grad Office must submit to the NCSU Graduate School at least 10 working days before the examination is scheduled	Initiated by student and submitted to the Graduate School by the graduate program. The Graduate School may take up to 10 working days to respond to the request.	Form is available in Plan of work file via ECE web page.
Report on Final Oral Examination (master's or doctoral)	Immediately after final oral exam	Chair of Student's committee must submit form to ECE Grad Office. ECE Grad Office must submit to the Graduate School by the DGP within 5 working days of exam	
Submission of thesis or dissertation to Graduate School	After final examination is successfully completed, corrections have been made, and by the graduation deadline for the	Student must schedule an appointment with the Thesis Editor of the Graduate School.	The appointment with the editor should be made well in advance. The end-of-semester times are very crowded.

	semester		
Request to Schedule the Preliminary Oral Examination (doctoral students only)	After written preliminary exams or qualifying review have been completed but no later than four months prior to final oral exam. Request must be submitted to ECE Grad Office 15 working days prior to exam date. The ECE Office must submit the request to the NCSU Graduate School at least 5-10 working days prior to proposed exam date (see right).	Initiated by student and submitted to the Graduate School by the DGP. The Graduate School responds in 5 working days if a Graduate School Representative (GSR) has already been assigned. If not, the Graduate School may take up to 10 working days to respond.	Form is available in Plan of work file via ECE web page.
Report on Preliminary Oral Examination (sample only) (doctoral students only)	Immediately after oral examination is completed	Chair of Student's committee must submit form to ECE Grad Office. ECE Grad Office must submit to the Graduate School by the DGP within 5 working days of exam	
Request to Schedule the Final Oral Examination (doctoral students only)	Request must be submitted to ECE Grad Office 15 working days prior to exam date. The ECE Office must submit the request to the NCSU Graduate School at least 5-10 working days prior to proposed exam date (see right), and no earlier than 4 calendar months after successful completion	Initiated by student and submitted to the Graduate School by the graduate program. The Graduate School responds in 5 working days if a GSR has already been assigned. If not, the Graduate School may take up to 10 working days to respond.	Form is available in Plan of work file via ECE web page.

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* Receipt of materials in the Graduate School can be by campus mail, hand delivery, fax, GARS, or e-mail, as appropriate.