ELECTRICAL ENGINEERING

GRADUATE STUDENT HANDBOOK

Master of Science
Doctor of Philosophy

Department of Electrical and Computer Engineering
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1. INTRODUCTION

This document serves as the source of information on the graduate program in the Department of Electrical and Computer Engineering and as a manual on current policies, procedures and guidelines for students and faculty involved in the program. It will be updated in a timely fashion to comply with regulation and requirement changes initiated both by the Graduate Curriculum Development (GCD) Committee in the Department of Electrical and Computer Engineering, the College of Engineering and the University. These changes will be initiated by the departmental GCD committee and approved by the department's faculty. Guidelines and policies stipulated in this manual form the formal basis for the program of study of each graduate student in the Department of Electrical and Computer Engineering. All graduate students must follow the requirements in the University Graduate Catalog and this handbook.

2. GRADUATE CURRICULUM DEVELOPMENT COMMITTEE

The Graduate Curriculum Development Committee is primarily responsible for:

- Reviewing the graduate curriculum and recommending course additions, deletions, and changes.
- Reviewing and selecting graduate applicants for admission, assistantships or fellowships.
- Preparing graduate program brochures and other informational material.
- Recommending and approving graduate policies, procedures and guidelines.
- Staying abreast of graduate activities, needs and the potential for service on a broad basis in order to better serve the Department, College, University and the State of North Carolina.

3. STUDENT GRADUATE ADVISORY COMMITTEE

Each graduate student will have a committee whose role is to:

- Assist the student in defining his/her program of study;
- Advise the student on proper procedures;
- Monitor and guide the progress of the student towards timely completion of his/her program;
- Assess and certify the student's program completion.

Overall responsibility on thesis or project research advisement remains with the Committee Chair and should be administered and/or performed accordingly.

4. GRADUATE PROGRAM GENERAL DESCRIPTION

The Master of Science Program in Electrical Engineering provides graduate level education for advanced professional practice or further graduate studies. The program is open to students with a bachelor's degree in a scientific discipline from an institution of recognized standing. The Doctoral Program is the terminal degree within the Department of Electrical and Computer Engineering at North Carolina A&T State University. The educational objectives of the graduate programs in Electrical Engineering are as follows:

1. To provide master and doctoral levels of study for students who have completed their bachelor's or master's degrees from North Carolina A&T State University, or an ABET accredited, equivalent university.

2. To provide local practicing electrical engineers from the Piedmont Triad with a part-time graduate program in electrical engineering.

3. To provide the region with a full-time graduate electrical engineering program.

4. To foster research in electrical engineering for the benefit of North Carolina A&T State University and its graduate students.

5. To enrich the undergraduate program as a result of student interaction with high quality engineering faculty who are concerned with graduate study and research.

6. To provide a graduate level electrical engineering resource base to support electrical engineering activities in local and regional industry and in government.

7. To foster industrial development in the state and region.

The programs emphasize areas of specialization, which are the current strengths of the department. Thus, the department offers the following four areas of concentration for the graduate programs:

- Computer Engineering
- Communications and Signal Processing
- Electronic and Optical Materials and Devices
- Power Systems and Control

There are other academic programs at the university that are related to the graduate programs in the Department of Electrical and Computer Engineering. These programs are important because they include academic subject matter of potential interest to students as supporting courses and areas of minor concentration. Specific supporting master's degree programs include:

- Applied Mathematics, Physics, Chemistry
- Computer Science
- Industrial Engineering
- Mechanical Engineering
- Architectural Engineering
- General (interdisciplinary) Engineering

The Graduate Program in the Department of Electrical and Computer Engineering offers the following degrees:

- Master of Science - Electrical Engineering
- Doctor of Philosophy - Electrical Engineering

5. GRADUATE PROGRAM ADMISSION REQUIREMENTS

5.1. ADMISSION REQUIREMENTS FOR MASTERS DEGREE PROGRAM

A student must first be admitted to the Graduate School completing the required application forms and submitting along with two official copies of the student's undergraduate and/or graduate transcripts to the Graduate School. An official GRE score is required for all overseas students. Satisfying the requirements described does not guarantee admission. Students are admitted solely by the department in three categories:

5.1.1 Unconditional Admission

An applicant may be unconditional admitted to the MSEE program if he/she possesses an undergraduate degree in Electrical Engineering from an ABET accredited institution with an overall GPA of 3.0 or better on a 4.0 scale. In addition, each applicant must have a 3.0 average in all of his or her engineering courses. International students are not given unconditional status unless they submit the GRE scores to the Graduate School.

5.1.2 Provisional Admission

Applicants may be granted provisional admission if they do not qualify for unconditional admission due to one or more of the following reasons:

a) Applicant has a non-Electrical Engineering baccalaureate engineering degree with a GPA of 3.0 or better, but he/she is deficient in required background courses: (Note: Applicants must take more than 4 background courses).

b) Applicant who does not have a degree from an ABET accredited curriculum (e.g. international students) did not submit the GRE scores. A minimum GRE score of Verbal + Quantitative = 1100 is required for the unconditional status.

c) Applicant has an overall GPA less than 3.0 in Electrical Engineering, but has a GPA over 2.8.

d) Electrical Engineering student has a GPA less than 2.8 with a minimum GRE Verbal + Quantitative scores of 1100.

A provisionally admitted student must achieve unconditional admission after completing all background courses and 9 graduate credit hours with an average of 3.0 or better. Upon the satisfaction of the above condition, the student may request through the Graduate Coordinator for conversion to the unconditional status by the Graduate School.

A Provisional student must not take more than 12 graduate credit hours in Electrical Engineering prior to receiving unconditional admission to the MSEE program. It is the student's responsibility to request his/her status change from the provisional status to the unconditional status by the Graduate School through the Graduate Coordinator. Students who fail to have their status upgraded run the risk of not receiving graduate credit for completed graduate courses.

5.1.3 Post-Baccalaureate Studies (PBS)

This category applies to students lacking a baccalaureate degree in engineering and requiring 9-15 hours of prerequisites in general engineering background who possess a GPA of 3.0 or better from an accredited program.

Upon completion of the required background courses with a "B" average or better, these students may reapply to the graduate program. However, the PBS student must not take more than 12 graduate credit hours in Electrical Engineering prior to applying for admission to the MSEE program. No more than 12 graduate credit hours earned in PBS status can be counted in his/her MSEE program.

All graduate students admitted in the Department of Electrical and Computer Engineering must meet with the Graduate Coordinator to obtain information about Graduate Program. The Graduate Coordinator assists students for registration and course selection until students selects a permanent advisor by mutual agreement between the student and the faculty member. Students must select a permanent advisor no more than 9 credit hours into the program or by the end of the first semester.

5.2. ADMISSION REQUIREMENTS FOR DOCTORAL DEGREE PROGRAM

All applications for admission to the Ph.D. program are subject to review by the Graduate Curriculum Development (GCD) Committee in the Department. The GCD Committee's recommendation is not subject to further review. Satisfying the requirements described below does not guarantee admission. Denial of admission does not necessarily imply a negative evaluation of an applicant's qualification. Limited space, facilities, funding and mismatch in areas of interest may place limitations on the number of students who may be admitted.

5.2.1 Unconditional Admission

The minimum admission requirements for the Ph.D. program are as follows:

1. The student seeking a Doctor of Philosophy Degree in Electrical Engineering must possess a Master of Science Degree in Electrical Engineering, Computer Engineering, or related disciplines.
2. The applicant should have an overall graduate GPA of 3.0 or better on a 4.0 scale.
3. The applicant must submit his/her GRE scores to the Department of Electrical and Computer Engineering.
4. The application must include three letters of recommendations, one of which must come from an individual knowledgeable of the student's graduate performance and potential. The recommendations must be sent to the Graduate School in sealed envelopes.
5. International students from non-English speaking countries must submit a TOEFL score.

5.2.2 Provisional Admission

Applicants may be granted provisional admission if they do not qualify for unconditional admission due to one or more of the following reasons:

a) Applicant does not have a 3.0 overall GPA in his/her master's degree. (Note: Applicant must have at least a 3.0 overall graduate GPA).

b) Applicant has a non-Electrical Engineering baccalaureate engineering degree with a GPA of 3.0 or better, but he/she is deficient in required background courses. (Note: Applicant must complete more than 4 background courses).

These applicants must submit their GRE scores to the Department of Electrical and Computer Engineering. The students in the provisional admission category must obtain 3.0 GPA after 12 credit hours earned in less than a year. Their status will then be changed to the unconditional status after this change is requested through the Graduate Coordinator.

All graduate students admitted in the Department of Electrical and Computer Engineering meet with the Graduate Coordinator to obtain information about Graduate Program. The Graduate Coordinator assists students for registration and course selection until students selects a permanent advisor by mutual agreement between the student and the faculty member. Students must select a permanent advisor no more than 9 credit hours into the program or by the end of the first semester.

6. MASTER DEGREE PROGRAM REQUIREMENTS

6.1. PROGRAM OPTIONS AND CREDIT-HOUR REQUIREMENTS

The Master of Science in Electrical Engineering program consists of three options: (a) Thesis Option (b) Project Option and (c) Course Only Option. The Thesis Option requires a minimum of 24 hours of coursework, at least 1 hour of 792, and 6 credit hours of master's thesis 797. The Project Option requires a minimum of 30 hours of coursework, at least 1 hour of 792, and 3 hours of 796. The Course Only Option requires 33 hours of coursework and at least 1 hour of 792. At least 12 credit hours for the thesis option and 15 credit hours for the project and course only options must be at or above the 700 level. A maximum of 6 hours of coursework may be taken outside the department, subject to approval by the student Advisory Committee.

6.2. SELECTION OF ADVISOR

At the beginning of the program, the student meets with the Graduate Coordinator to obtain information about the Graduate Program. The Graduate Coordinator assists the student for registration and course selection until the student selects a permanent advisor by mutual consent. Students must select a permanent advisor no more than 9 credit hours into the program or by the end of the first semester.

6.3. THE GRADUATE PLAN OF STUDY FOR THE MASTER DEGREE PROGRAM

Before the completion of 12 credit hours of course work, the student and his/her advisor must establish the Graduate Plan of Study for the student's master's program and submit the original with signatures of all members of the Advisory Committee to the Department Office with copies to the Graduate Coordinator, the Graduate School and all committee members. The student must submit the Graduate Plan of Study no later than the completion of 12 credit hours. The Graduate Plan of Study must show the committee chairperson, other committee members, and a chronological list of courses approved by the student's advisor. A committee member's signature on the Graduate Plan of Study denotes their approval of the plan for the student's mater's program. After approval by the Graduate Coordinator, the Graduate Plan of Study becomes the student's official guide to completion of his/her master's degree program.

6.4. CHANGE OF ADVISOR AND STUDY PLAN

A student may change his/her advisor at any time through a mutual consent. When a student changes his/her advisor, the student must submit a revised Graduate Plan of Study including signatures by the new advisor and all committee members and the consent of the previous advisor. After the submission of a Graduate Plan of Study, a student must resubmit a changed Graduate Study Plan to the Graduate Coordinator indicating that the plan has been "REVISED" and including the signatures of his/her advisor and all committee members.

6.5. THE ADVISORY COMMITTEE

The advisor and the student form the Advisory Committee for the student's thesis/project before the submission of the Graduate Plan of Study. In general, the student's committee will have a minimum of three members for the thesis option and two members for the project option. The chair of the Advisory Committee must be a faculty member in the Department of Electrical and Computer Engineering. It is expected that members of this committee will be selected from faculty who have both the time and the interest to assist the particular student. Only one member of the committee may be selected from outside of the department. A co-advisor may be selected from outside of the department for the student Advisory Committee. A co-advisor is responsible for the student's research work and financial support in a spirit of cooperation with the main advisor in the department. The main advisor is responsible for advising the overall plan of the student's degree program. However, a co-advisor from outside of department must apply in writing and be approved by the Graduate Curriculum Development (GCD) Committee in the department.

6.6. THESIS/PROJECT ORAL EXAMINATION

The student must present his/her thesis/project work to the Advisory Committee for the thesis or project Oral Examination. In order to schedule the thesis/project Oral Examination, the student must submit an Application for Oral Examination including signatures of all members of the Advisory Committee to the departmental office at least two weeks prior to the date of the Oral Examination. This notification must include the date, time and place of the Oral Examination. The student requesting his/her Oral Examination must distribute a copy of the thesis/project to all members of his/her committee two weeks prior to the date of the Oral Examination. The copy of the application form for the Oral Examination, as approved by the Graduate Coordinator, must be sent to the members of the committee to confirm the approval, date and place. If any committee member cannot attend the scheduled Oral Examination, it must be rescheduled. The location of a thesis/project Oral Examination must be on-campus so that the presentation is accessible to faculty, staff and students.

6.7. SUBMISSION OF THESIS/PROJECT

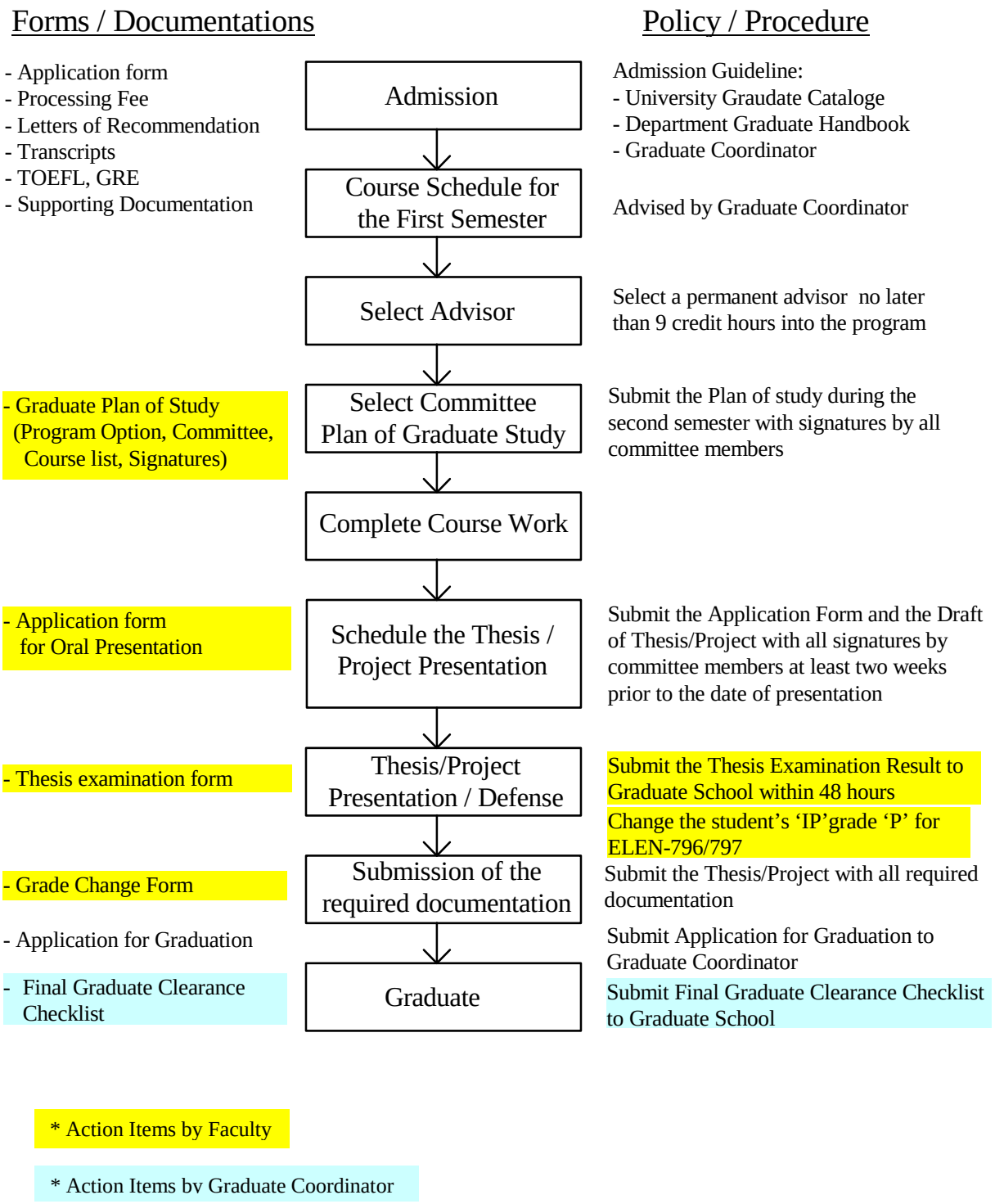
Upon passing the thesis/project Oral Examination, the student must have the thesis approved by the advisor and the chairman of Electrical and Computer Engineering Department. The thesis must be submitted to the Graduate

School by the deadline given in the academic calendar, and must conform to the Guide for Preparation of a Thesis, a copy of which may be obtained from the Graduate School. The student's project report for the project option must be submitted to the departmental office.

6.8. SUMMARY OF PROCEDURES FOR THE MASTERS DEGREE PROGRAM

1. Apply for admission to the Graduate School.
   (a) The application and all supporting documentation are sent to the Graduate School.
   (b) The application material includes the followings:
      - The signed application form, application processing fee, letters of recommendation, N.C. residency form (if applicable), acknowledgement card, letter of intent, official transcripts, and other supporting documents
2. Student receives admission decision from the Graduate School.
3. Student submits the enrollment intention card to the Graduate School.
4. Student meets with the Graduate Coordinator to obtain information about graduate programs.
5. Student prepares course schedule and registers for classes under the supervision of the Graduate Coordinator.
6. Graduate Coordinator may assign a temporary advisor until a permanent advisor is found.
7. Student selects a permanent advisor no more than 9 credit hours into the program or by the end of the first semester.
8. Student completes the Plan of Study for the Master's program in consultation with his/her advisor no later than the completion of 12 credit hours including the following:
   - Selection of the Program Option (Thesis, Project, and Course Only)
   - Selection of the advisory committee members according to the program option
   - Course list according to the coursework requirement
   - Signatures of all members of the advisory committee
9. Student submits the original Plan of Study to the departmental office along with copies to the Graduate Coordinator, the Graduate School and all committee members no later than the end of the second semester.
10. This Plan of Study becomes the student's official guide for the student's master's degree program.
11. If a student decides to change his/her Plan of Study, the student must restart from Step 7 above.
    - The revised Plan of Study must include the word "REVISED".
12. Student completes all the coursework.
13. For the Thesis/Project options, student schedules the Thesis/Project presentation and defense in consultation with his/her advisor, and submits the Application for Oral Examination to the Graduate Coordinator and the Graduate School with all signatures from the advisory committee. Upon approval of the request, the student submits the written report for the Project Option or the draft of the thesis for the Thesis Option to all committee members for review at least two weeks prior to the suggested date. The student completes the Thesis/Project presentation and defense.
14. The examination result is sent to the Graduate School with signatures of all committee members and the Graduate Coordinator within 48 hours.
15. Student submits Application for Graduation to the Graduate Coordinator, and then the Graduate Coordinator submits Final Graduate Clearance Checklist to the Graduate School.
16. All of the required documentation is submitted to the Graduate School and the Department Office.
17. The student graduates.

Master Program Steps



7. DOCTORAL DEGREE PROGRAM REQUIREMENTS

7.1. CREDIT-HOUR REQUIREMENTS

The Ph.D. program in Electrical Engineering is based on the Dissertation Option. This program requires 24 credit hours of coursework. At least 12 credit hours must be at the 800 level. 600 level courses are not counted in the coursework requirement except for courses related to student's Qualifying Examination. A minimum of 12 credit hours of doctoral dissertation 997, 3 hours of 992, 3 hours of 991 and 3 hours of 995 are required. No more than 6 credit hours at the graduate level in an area outside of electrical engineering may be accepted to satisfy a graduate area concentration. Thus, a total of 45 credit hours are required for the doctoral degree. The student is encouraged to take all courses related to the subjects selected for his/her Qualifying Examination.

7.2. DISSERTATION RESEARCH

There is no limit to the maximum number of dissertation credits for Ph.D. students. However, no more than 12 dissertation credits are counted toward the 45 credit hours requirement described above. Student can not register the dissertation credits before passing Qualifying Examination.

7.3. SELECTION OF ADVISOR

At the beginning of the first semester, each student meets with the Graduate Coordinator for the assignment of an advisor in an area of interest to the student. The Graduate Coordinator assists students with registration and course selection until students select a permanent advisor. By the end of the first semester or the first 9 credit hours for each student, a permanent advisor is identified.

7.4. DOCTORAL ADVISORY COMMITTEE

The advisor and the advisee must form the Advisory Committee in the second semester or before the student completes 12 hours of course work. The Advisory Committee for a Ph.D. student consists of a chairperson in the student's major subject and four other members. The Advisory Committee must include a Graduate School Representative selected from outside of the department in an area not related to the student's dissertation area. The Graduate School Representative is appointed by the Graduate School for monitoring the fair evaluation of the exams for the student's degree program. The Graduate School Representative attends the preliminary and final oral examinations, and must sign the reports of the examinations. However, he or she does not participate in directing the student's technical work. The chair must be selected from the Department of Electrical and Computer Engineering based on the area of emphasis chosen by the student. More than half of the members must be selected from the Department of Electrical and Computer Engineering. The Advisory Committee may consist of co-advisor. A co-advisor from outside of the department must apply in writing and be approved by the Graduate Curriculum Development (GCD) Committee in the department.

7.5. THE GRADUATE PLAN OF STUDY FOR DOCTORAL PROGRAM

Before the student completes 12 credit hours of course work, the student and his/her advisor establish the Graduate Plan of Study for the student's doctoral program and submit the original with signatures of all members of the Advisory Committee to the Department Office with copies to the Graduate Coordinator, the Graduate School and all committee members. The Graduate Plan of Study shows the committee chairperson, other committee members, and a chronological list of courses approved by the student's advisor. A committee member's signature on the Graduate Plan of Study denotes their approval of the plan for the student's doctoral program. After approval by the Graduate Coordinator in the department, the Graduate Plan of Study becomes the student's official guide to completion of his/her doctoral program and the official list of individuals who form the Ph.D. Advisory Committee.

7.6. RESIDENCE REQUIREMENTS

Each Ph.D. student must secure at least two residence credits through registration in continuous semesters at North Carolina A&T State University. Residence credit is determined from the number of semester hours completed during a regular semester according to the following table. Summer registration is not required. However, residence

credit for a six-week summer session equals one-half that of a regular semester. For example, completing a three-credit course during a six-week summer session will earn 1/6 of a regular semester residence credit.

Semester Credit Hours	Residence Credits
9 or more	1
6 - 8	2/3
less than 6	1/3
(including registration for "Dissertation"	

7.7. CHANGE OF COMMITTEE MEMBERS AND STUDY PLAN

A student may change his/her advisor at any time through a mutual consent. When a student changes his/her advisor, the student must submit a revised Graduate Plan of Study including signatures by the new advisor and all committee members and the consent of the previous advisor. After the submission of a Graduate Plan of Study, a student must resubmit a changed Graduate Study Plan to the Graduate Coordinator indicating that the plan has been "REVISED" and including the signatures of his/her advisor and all committee members.

7.8. Ph.D. QUALIFYING EXAMINATION

The purpose of the Qualifying Examination is to identify students who are qualified to work toward the Ph.D. degree in Electrical Engineering by requiring these students to demonstrate basic competence in a broad range of relevant subjects. Students are not expected to engage in research until they have passed their Qualifying Examination.

All students in the doctoral program must take this examination within two years plus one semester of their admission to the Ph.D. program. Only students with unconditional status can apply for the Qualifying Examination. Any students in provisional status can not sit for the Qualifying Examination. A student must be enrolled with a 3.0 GPA or better at the time of the examination. A student must also have the approved Graduate Plan of Study for his/her doctoral program on file with the Graduate School prior to scheduling the exam. The Qualifying Examination is given each regular (Fall and Spring) semester on two successive days during the week before the final exam period. A registration notice will be posted outside the Department Office in the middle of each academic semester. The student must apply for the Qualifying Examination by the posted deadline.

The examination consists of a three-hour written examination for each subject and covers two subjects per day in two consecutive days. At the time of registration, the student declares the track in which he or she will be taking the examination. Each student must select only two subjects in his/her concentration area and two subjects from other areas from the following list:

Subjects and Its Core Courses for Ph.D. Qualifying Exam

**. The student must select only two major subjects as his/her concentration area, and two additional subjects from other areas as student's minor fields among the following subject list:*

1. Digital Signal Processing: (C&S)	ELEN650 - Digital Signal Processing I ELEN850 - Digital Signal Processing II
2. Communication System: (C&S)	ELEN749 - Digital Communications ELEN849 - Data Communications
3. Pattern Recognition and Computer Vision: (C&S)	ELEN657 - Image Processing ELEN857 - Pattern Recognition

4. Computer Networks: (C&S)	ELEN647 - Introduction to Telecommunication Networks ELEN847 - Telecommunication Networks
5. Systems and Control: (P&C)	ELEN668 - Automatic Control Theory ELEN865 - Theory of Linear Systems
6. Machine Intelligence: (P&C)	ELEN674 - Genetic Algorithms ELEN870 - Fuzzy Logic with Applications
7. Neural Networks: (P&C)	ELEN678 - Introduction to Artificial Neural Networks ELEN867 - Neural Networks Design
8. Power System: (P&C)	ELEN661 - Power Systems Analysis ELEN861 - Power System Control and Protection
9. Optical Materials and Devices: (M&D)	ELEN710 - Waves and Fields in RF and Optoelectronics ELEN810 - Theory and Techniques in Photonics
10. Semiconductor Materials and Devices: (M&D)	ELEN602 - Semiconductor Theory and Devices ELEN801 - Solid State Devices
11-A. Fault Tolerant Computing: (CPE)	ELEN721 - Fault-Tolerant Digital System Design ELEN822 - Error-Correcting Codes
11-B. VLSI Systems: (CPE)	ELEN629 – VLSI Circuit Design ELEN724 – Mixed-Signal VLSI Design
12. Digital System Design: (CPE)	ELEN623 – Digital Systems ELEN723 - System Design Using Programmable Logic Devices
13. Computer Architecture: (CPE)	ELEN624 - Computer Organization and Architecture Design ELEN821 - Advanced Computer Organization and Architecture

- *Student can select either S11-A or S11-B, but not both.*
- *Student must select only two subjects in his/her concentration area and two from other areas.*

Questions on the Qualifying Examination are developed based on the contents of the above courses. Thus, each student is encouraged to take all courses related to the subjects selected for his/her Qualifying Examination.

Students must obtain an overall score of at least 80% to pass the examination. A student who has failed the Qualifying Examination one time is given a second chance to retake the Qualifying Examination within a year. A student whose overall score is below 80% must retake the examination. The student who needs to retake the examination can not change any subjects selected in the first attempt. The Graduate Coordinator will notify each examinee of his or her results by letter within three weeks from the date of examination.

A student who wants to retake the Qualifying Examination must apply the Qualifying Examination by the posted deadline. No student is permitted to take the Qualifying Examination more than twice. A student not recommended for re-examination, or who fails the exam on a second attempt is afforded the opportunity to withdraw from the university. A student who chooses not to withdraw will have his or her graduate program terminated upon completing the semester in which the denial or second failure occurs. Also, a student who fails to take the examination or re-examination at the prescribed time is considered to have taken and failed the examination or re-examination.

7.9. Ph.D. PRELIMINARY ORAL EXAMINATION

After passing the Qualifying Examination, each Ph.D. student must complete a preliminary oral examination conducted by the student's Advisory Committee, which the representative from the Graduate School attends. This is an Oral Examination and defense of the student’s dissertation proposal. Passing this exam allows the Graduate

School to enter the student into "*Ph.D. Candidacy*".

Unanimous approval by the Advisory Committee is required to pass the examination. Approval may be conditioned on satisfactory completion of additional work. In this situation, a student passes the examination when these conditions are met. A student is admitted to candidacy for the Ph.D. degree only upon passing the preliminary examination. Failure of the examination terminates the student's graduate study unless the student's Advisory Committee unanimously recommends re-examination. Only one re-examination is permitted and at least one full semester must elapse before the re-examination.

The 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. The Preliminary Oral Examination is scheduled at the request of the student and only upon the approval of the student's Advisory Committee. A student cannot submit a request to schedule an oral examination unless the student's Graduate Plan of Study has been approved by the Graduate Coordinator. The student must be in good academic standing when the request is submitted and when the examination is held.

The student must submit the Application for Oral Examination with the signatures of all members of the Advisory Committee to the Department Office at least two weeks prior to the date of the Preliminary Examination. The application form must include the date, time and place of the preliminary examination. The student requesting his/her oral examination must distribute a copy of the written report to all members of his/her committee two weeks prior to the date of the Preliminary Oral Examination. The copy of the application form for the preliminary examination (approved by the Graduate Coordinator) is sent to the student and the members of the committee to confirm the approval, date and place of the examination. If any committee member can not attend a scheduled preliminary examination, it must be rescheduled.

7.10. Ph.D. FINAL ORAL EXAMINATION

Each Ph.D. student must pass a Final Oral Examination conducted by the student's Advisory Committee, which a representative from the Graduate School attends. This examination is the final dissertation defense presentation that is scheduled after a dissertation is completed. It consists of the defense of the methodology used and the conclusions reached in the research in the dissertation. Unanimous approval by the Advisory Committee is required for passing an oral 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 Advisory Committee unanimously recommends re-examination. Only one re-examination is permitted.

The examination may be held no earlier than one semester (or four months) after admission to candidacy. The examination must be held on or before the deadline for final oral examinations (see the academic calendar in the Graduate Catalog) if the degree is to be awarded at the end of that semester otherwise, the degree is awarded at the end of the following semester. The examination is scheduled only upon the request of the student and the approval of his or her Advisory Committee. The student must submit the Application for Oral Examination with the signatures of all members of the Advisory Committee to the Department Office at least two weeks prior to the date of the Final Oral Examination. The application form must include the date, time and place of the Final Oral Examination. The dissertation must be completed and copies of it must be distributed to all members of his/her Advisory Committee two weeks prior to the date of the Final Oral Examination. The copy of the application form for the Final Oral Examination (approved by the Graduate Coordinator) is sent to the student and the members of the committee to confirm the approval, date and place of the defense. If any committee member can not attend a scheduled Final Oral Examination, it must be rescheduled.

7.11. SUBMISSION OF DISSERTATION

Upon passing the Ph.D. Final Oral Examination, each Ph.D. student must have the dissertation approved by each member of the student's Advisory Committee. The dissertation must be submitted to the Graduate School by the deadline given in the academic calendar, and must conform to the Guide for Preparation of Thesis and Dissertations, a copy of which may be obtained from the Department Office.

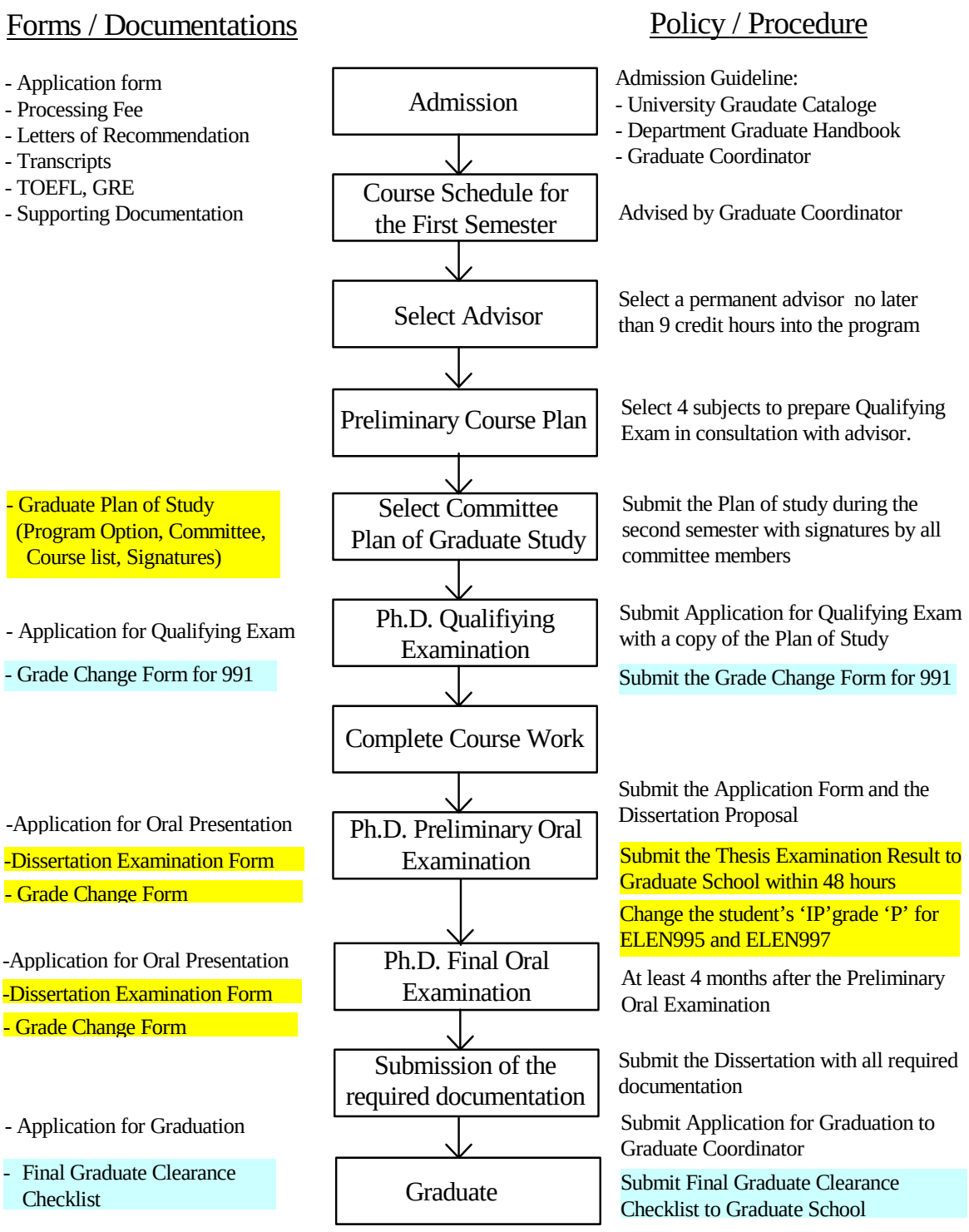
7.12. SUMMARY OF PROCEDURES FOR THE DOCTORAL PROGRAM

1. Apply for admission to the Graduate School
   a) The application and all supporting documentation are sent to Graduate School.
   b) The application material includes the following:

- The signed application form, application processing fee, letters of recommendation, N.C. residency form (if applicable), acknowledgement card, letter of intent, official transcripts, and other supporting documents

2. Student receives admission decision from the Graduate School.
3. Student reports his or her enrollment intentions to the Graduate School.
4. Student meets with the Graduate Coordinator to obtain information about graduate programs.
5. Student prepares the course schedule and registers for first semester classes under the supervision of the Graduate Coordinator.
6. Graduate Coordinator may be a temporary advisor until a permanent advisor is found.
7. Student selects a permanent advisor no more than 9 credit hours into the program.
8. Student completes the Graduate Plan of Study for the doctoral program in consultation with his/her advisor during the second semester and includes the following activities in this process:
   - Selection of the advisory committee members. The advisory committee consists of a chairperson in the student's major subject, and four other members.
   - Selection of course list according to coursework requirements. The coursework may include courses in preparation for the Qualifying Examination.
   - Obtaining signatures of all members of the advisory committee
9. Student submits the original Plan of Study to the Department Office with copies to the Graduate Coordinator, the Graduate School and all committee members no later than the end of the second semester.
10. This Plan of Study becomes the student's official guide for the student's Ph.D. degree program.
11. If a student decides to change his/her Plan of Study, the student must restart from Step 7 above.
12. The revised Plan of Study must include the word "REVISED".
13. Student takes Qualifying Examination within two years plus one semester of student's admission to the Ph.D. program.
14. Whenever the direction of the student's dissertation topic has been determined in consultation with his/her advisor, the student submits the dissertation title and the outline of the proposed research to the student's Advisory Committee.
15. Student completes all coursework.
16. After passing the Qualifying Examination, and when the proposed research is in a mature stage and is likely to succeed in experimentation, the student schedules the Preliminary Oral Exam in consultation with his/her advisor and forwards the exam schedule to the Graduate Coordinator and the Graduate School. After their approval, the student and his/her advisor post the time and place of the examination and submit a written report to all committee members including the representative of the Graduate School for their review at least two weeks prior to the examination date.
17. The examination result is sent to the Graduate School in 48 hours and if the examination has been passed without conditions, the student is admitted as a "*Ph.D. Candidate*".
18. At least one semester (or four months) of "*Ph.D. Candidacy*", the student schedules the Final Oral Examination in consultation with his/her advisor. The student must submit the Application for Oral Examination with the signatures of all members of the Advisory Committee to the Graduate Coordinator at least two weeks prior to the date of the Final Oral Examination. Upon approval of this request, the student and his/her advisor must post the time and place of the exam and submit a copy of the draft of his/her dissertation to all committee members including the representative of the Graduate School for their review by two weeks prior to the suggested date.
19. The examination result is sent to the Graduate School with signatures of all advisory committee members and the in 48 hours.
20. Student submits Application for Graduation to the Graduate Coordinator, and then the Graduate Coordinator submits Final Graduate Clearance Checklist to the Graduate School.
21. Student submits all required documentation to the Graduate School and the Department Office.
22. The student graduates.

Ph.D. Program Steps



8. SPECIALIZATION OPTION

The field of electrical engineering has grown in breadth as well as in depth; consequently, it is possible to achieve levels of specialization in several area options. Thus, the department specializes in the following four areas for the master's and doctoral programs:

- Communications and Signal Processing
- Computer Engineering
- Electronic and Optical Materials and Devices
- Power Systems and Control

A student may select any area as a major in this department and concentration courses in related areas with the guidance of his/her advisor. The following pages present the list of courses for each area.

Communication and Signal Processing Course List

600 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-647	Introduction to Telecommunication Networks	3	Spring
ELEN-650	Digital Signal Processing-I	3	Fall
ELEN-651	Digital Signal Processing Laboratory	2	Fall
ELEN-656	Probability and Random Processes	3	Fall
ELEN-657	Digital Image Processing	3	Spring
ELEN-658	Digital Image Processing Laboratory	2	Spring
ELEN-685	Selected Topics in Engineering	3	Fall/Spring
ELEN-686	Special Projects	1-3	Fall/Spring

700 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-749	Digital Communications	3	Fall
ELEN-752	Wireless Information Networks	3	Spring

800 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-847	Telecommunication Networks	3	Fall
ELEN-848	Information Theory	3	Spring
ELEN-849	Data Communications	3	Spring
ELEN-850	Digital Signal Processing-II	3	Spring
ELEN-857	Pattern Recognition	3	Fall
ELEN-869	Machine Vision for Intelligent- Robotics	3	Fall

UNDERGRADUATE BACKGROUND:

Courses	Titles	Hours	Semester
ELEN-400	Linear Systems and Signals	3	Fall/Spring
ELEN-449	Introduction to Communication Systems	3	Spring
ELEN-452	Wireless Communication Systems	3	Fall
ELEN-459	Digital and Data Communications	3	Fall

Computer Engineering Course List

LOWER 600 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-621	Embedded Systems Design	3	Fall
ELEN-622	Embedded Systems Design Laboratory	2	Fall
ELEN-623	Digital Systems	3	Fall
ELEN-624	Computer Organization and Architecture Design	3	Spring
ELEN-629	VLSI Circuit Design	3	Spring
ELEN-630	VLSI Design Laboratory	2	Spring

700 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-720	Theoretical Issues in Computer Engineering	3	Spring
ELEN-721	Fault-Tolerant Digital System Design	3	Spring
ELEN-723	System Design Using Programmable Logic Devices	3	Spring
ELEN-724	Mixed-Signal VLSI Design	3	Spring
ELEN-725	Pervasive Computing Systems	3	Spring
ELEN-727	Switching and Finite Automata Theory	3	Fall

800 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-821	Advanced Computer Organization and Architecture	3	Fall
ELEN-822	Error-Correcting Codes	3	Spring
ELEN-823	Advanced VLSI Design	3	Fall

UNDERGRADUATE BACKGROUND:

Courses	Titles	Hours	Semester
ELEN-327	Digital Logic	3	Fall/Spring
ELEN-427	Introduction to Microprocessors	3	Fall/Spring
ELEN-433	Digital Systems Laboratory	3	Fall/Spring

Electronic and Optical Materials and Devices Course List

600 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-602	Semiconductor Theory and Devices	3	Fall
ELEN-606	Digital Electronics	3	Fall/Spring
ELEN-608	Analog Electronics	3	Fall/Spring
ELEN-610	Power Electronics	3	Fall/Spring
ELEN-614	Integrated Circuit Fabrication Methods	3	Spring
ELEN-615	Silicon Device Fabrication Laboratory	2	Spring

700 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-701	Electronic Ceramics	3	Spring
ELEN-710	Wave and Fields in RF and Optoelectronics	3	Fall

800 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-801	Solid State Devices	3	Spring
ELEN-802	Advanced Solid State Theory	3	Fall
ELEN-803	Compound Semiconductor Materials and Devices	3	Spring
ELEN-804	Semiconductor Material and Device Characterization	3	Fall
ELEN-805	Thin Film Technology for Device Fabrication	3	Spring
ELEN-810	Theory and Techniques in Photonics	3	Spring
ELEN-812	RF CMOS Integrated Circuits	3	Fall

UNDERGRADUATE BACKGROUND:

Courses	Titles	Hours	Semester
ELEN-450	Electromagnetic Radiation and Microwave Theory	3	Fall
ELEN-460	Electronics II	3	Fall/Spring
ELEN-470	Properties of Materials for Electrical Engineering	3	Spring

Power Systems and Control Course List

600 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-661	Power Systems Analysis	3	Fall
ELEN-662	Advanced Power Systems Laboratory	2	Fall
ELEN-668	Automatic Control Theory	3	Fall
ELEN-669	Control Laboratory	2	Fall
ELEN-674	Genetic Algorithms	3	Spring
ELEN-678	Introduction to Artificial Neural Networks	3	Fall
ELEN-679	Machine Intelligence Laboratory	2	Fall

700 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-762	Network Matrices and Graphs	3	Fall
ELEN-764	Power System Planning	3	Fall

800 LEVEL COURSES:

Courses	Titles	Hours	Semester
ELEN-861	Power Systems Control and Protection	3	Fall
ELEN-862	Computer Methods in Power Systems	3	Fall
ELEN-865	Theory of Linear Systems	3	Spring
ELEN-866	Discrete Time Systems	3	Fall
ELEN-867	Neural Networks Design	3	Spring
ELEN-868	Intelligent Methods for Control Systems	3	Fall
ELEN-870	Fuzzy Logic with Applications	3	Fall
ELEN-871	Nonlinear Control Systems	3	Fall

UNDERGRADUATE BACKGROUND:

Courses	Titles	Hours	Semester
ELEN-410	Linear Systems and Control	3	Spring
ELEN-420	Power Electronics	3	Fall/Spring
ELEN-430	Power Systems, Energy Conversion and Electric Machinery	3	Fall/Spring
ELEN-436	Power Systems, Energy Conversion and Electric Machinery Laboratory	3	Fall/Spring

General Course List for 600, 700, 800 and 900 Levels

600 LEVEL COURSES:

Courses	Titles	Hours	Grade
ELEN-685	Selected Topics in Engineering	3	Graded
ELEN-686	Special Projects	1-3	Graded

700 LEVEL COURSES:

Courses	Titles	Hours	Grade
ELEN-785	Masters Special Topics	3	Graded
ELEN-792	Masters Seminar	1	Pass / Fail
ELEN-793	Masters Supervised Teaching	3	Pass / Fail
ELEN-794	Masters Supervised Research	3	Pass / Fail
ELEN-796	Masters Project	3	Pass / Fail
ELEN-797	Masters Thesis	3 -6	Pass / Fail
ELEN-799	Masters Thesis Continuation	1	Pass / Fail

800 & 900 LEVELS COURSES:

Courses	Titles	Hours	Grade
ELEN-885	Doctoral Special Topics	3	Graded
ELEN-991	Doctoral Qualifying Examination	3	Pass / Fail
ELEN-992	Doctoral Seminar	1	Pass / Fail
ELEN-993	Doctoral Supervised Teaching	3	Pass / Fail
ELEN-994	Doctoral Supervised Research	3	Pass / Fail
ELEN-995	Doctoral Preliminary Examination	3	Pass / Fail
ELEN-997	Doctoral Dissertation	3 - 12	Pass / Fail
ELEN-999	Doctoral Dissertation Continuation	1	Pass / Fail

* ELEN-685, 785 and 885 are experimental courses that are being used to create new courses.
* ELEN-x93, x94 and x99 are graded by Pass/Fail, and not counted as course credit requirements.

SUMMARY OF COURSE OFFERINGS

The 600 level courses numbered 600-699 are open to qualified seniors and graduate students for the master's program. Courses numbered 700 and above are only open to graduate students.

COURSE #	DESCRIPTION	CREDIT HOURS
ELEN 602	Semiconductor Theory and Devices	3 (3-0)
ELEN 606	Digital Electronics	3 (3-0)
ELEN 608	Analog Electronics	3 (3-0)
ELEN 610	Power Electronics	3 (3-0)
ELEN 614	Integrated Circuit Fabrication Methods	3 (3-0)
ELEN 615	Silicon Device Fabrication Laboratory	2 (1-3)
ELEN 621	Embedded Systems Design	3 (3-0)
ELEN 622	Embedded Systems Design Laboratory	2 (1-3)
ELEN 623	Digital Systems	3 (3-0)
ELEN 624	Computer Organization and Architecture Design	3 (3-0)
ELEN 629	VLSI Circuit Design	3 (3-0)
ELEN 630	VLSI Design Laboratory	2 (1-3)
ELEN 647	Introduction to Telecommunication Networks	3 (3-0)
ELEN 650	Digital Signal Processing I	3 (3-0)
ELEN 651	Digital Signal Processing Laboratory	2 (1-3)
ELEN 656	Probability and Random Processes	3 (3-0)
ELEN 657	Digital Image Processing	3 (3-0)
ELEN 658	Digital Image Processing Laboratory	2 (1-3)
ELEN 661	Power Systems Analysis	3 (3-0)
ELEN 662	Advanced Power Systems Laboratory	2 (1-3)
ELEN 668	Automatic Control Theory	3 (3-0)
ELEN 669	Control Laboratory	2 (1-3)
ELEN 674	Genetic Algorithms	3 (3-0)
ELEN 678	Introduction to Artificial Neural Networks	3 (3-0)
ELEN 679	Machine Intelligence Laboratory	2 (1-3)
ELEN 685	Selected Topics in Engineering	3 (3-0)
ELEN 686	Special Projects	Var. 1-3
ELEN 701	Electronic Ceramics	3 (3-0)
ELEN 710	Wave and Fields in Radio Frequency (RF) and Optoelectronics	3 (3-0)
ELEN 720	Theoretical Issue in Computer Engineering	3 (3-0)
ELEN 721	Fault-Tolerant Digital System Design	3 (3-0)
ELEN 723	System Design Using Programmable Logic Devices	3 (3-0)
ELEN 724	Mixed-Signal VLSI Design	3 (3-0)
ELEN 725	Pervasive Computing Systems	3 (3-0)
ELEN 727	Switching and Finite Automata Theory	3 (3-0)
ELEN 749	Digital Communications	3 (3-0)
ELEN 752	Wireless Information Networks	3 (3-0)
ELEN 762	Network Matrices and Graphs	3 (3-0)
ELEN 764	Power System Planning	3 (3-0)

ELEN 785	Masters Special Topics	3 (3-0)
ELEN 792	Masters Seminar	1 (1-0)
ELEN 793	Masters Supervised Teaching	3 (0-3)
ELEN 794	Masters Supervised Research	3 (0-3)
ELEN 796	Masters Project	3 (3-0)
ELEN 797	Masters Thesis	Var. (3-6)
ELEN 799	Masters Thesis Continuation	1 (0-1)
ELEN 801	Solid State Devices	3 (3-0)
ELEN 802	Advanced Solid State Theory	3 (3-0)
ELEN 803	Compound Semiconductor Materials and Devices	3 (3-0)
ELEN 804	Semiconductor Material and Device Characterization	3 (3-3)
ELEN 805	Thin Film Technology for Device Fabrication	3 (3-0)
ELEN 810	Theory and Techniques in Photonics	3 (3-0)
ELEN 812	RF CMOS Integrated Circuits	3 (2-3)
ELEN 821	Advanced Computer Organization and Architecture	3 (3-0)
ELEN 822	Error-Correcting Codes	3 (3-0)
ELEN 823	Advanced VLSI Design	3 (3-0)
ELEN 847	Telecommunication Networks	3 (3-0)
ELEN 848	Information Theory	3 (3-0)
ELEN 849	Data Communications	3 (3-0)
ELEN 850	Digital Signal Processing II	3 (3-0)
ELEN 857	Pattern Recognition	3 (3-0)
ELEN 861	Power System Control and Protection	3 (3-0)
ELEN 862	Computer Methods in Power Systems	3 (3-0)
ELEN 865	Theory of Linear Systems	3 (3-0)
ELEN 866	Discrete Time Systems	3 (3-0)
ELEN 867	Neural Networks Design	3 (3-0)
ELEN 868	Intelligent Methods for Control Systems	3 (3-0)
ELEN 869	Machine Vision for Intelligent-Robotics	3 (3-0)
ELEN 870	Fuzzy Logic with Applications	3 (3-0)
ELEN 871	Nonlinear Control Systems	3 (3-0)
ELEN 885	Doctoral Special Topics	3 (3-0)
ELEN 991	Doctoral Qualifying Examination	3 (0-3)
ELEN 992	Doctoral Seminar	1 (0-1)
ELEN 993	Doctoral Supervised Teaching	3 (0-3)
ELEN 994	Doctoral Supervised Research	3 (0-3)
ELEN 995	Doctoral Preliminary Examination	3 (0-3)
ELEN 997	Doctoral Dissertation	Var. (3-12)
ELEN 999	Doctoral Dissertation Continuation	1 (0-1)

9. DESCRIPTION OF GRADUATE COURSES

In the Master's and Doctoral Degree Programs in Electrical and Computer Engineering,

ELEN-602 Semiconductor Theory and Devices **Credit 3(3-0)**
This course is a study of the phenomena of solid-state conduction and devices using band models, excess carriers in semiconductors, p-n junctions, and devices. Prerequisites: ELEN-460 or consent of instructor.

ELEN-606 Digital Electronics **Credit 3(3-0)**
This course covers analysis, design and applications of digital integrated circuits. These circuits may include resistor-transistor logic (RTL), diode transistor logic (DTL), transistor-transistor (TTL), emitter-coupled logic (ECL), metal-oxide-semiconductor (MOS) gates and n-channel MOS (NMOS) logic, complementary MOS (CMOS) logic, Bipolar CMOS (BiCMOS) structures, memory circuits, and interfacing circuits. Prerequisite: ELEN-460 or consent of instructor.

ELEN-608 Analog Electronics **Credit 3(3-0)**
This course covers the analysis, design and application of analog integrated circuits. These circuits may include operational amplifiers, voltage comparators, voltage regulators, Integrated Circuit (IC) power amplifiers, Digital to Analog (D/A) and Analog to Digital (A/D) converters, voltage-controlled oscillators, phase-locked loops, other special-function integrated circuits. Prerequisite: ELEN-460 or consent of instructor.

ELEN-610 Power Electronics **Credit 3(3-0)**
This course is an introduction to principles and methods of power electronics. Subjects covered are semiconductor devices and their complementary components and systems, different static switching converters like AC to DC AC to AC, DC to DC and DC to AC converters and their applications. Pre-requisite: ELEN-320 or consent of instructor.

ELEN-614 Integrated Circuit Fabrication Methods **Credit 3(3-0)**
This course presents the various processes utilized in the fabrication of semiconductor integrated circuits. Oxidation, diffusion, ion implantation, metalization, and epitaxial processes will be discussed. Limits on device design and performance will be considered. Prerequisite: ELEN-470 or consent of instructor.

ELEN-615 Silicon Device Fabrication Laboratory **Credit 2(1-3)**
Laboratory experiments in the fabrication of silicon p-n junction diodes, MOS capacitors and MOS field effect transistors will be performed. Oxidation, diffusion, photolithography, and metalization techniques will be presented. Co-requisite: ELEN-614.

ELEN-621 Embedded Systems Design **Credit 3(3-0)**
This course is a survey of modern methods for specifying algorithms, simulating systems, and mapping specifications onto embedded systems. It presents an introduction to the technologies used in the design and implementation of programmable embedded systems, such as programmable processors, cores, memories, dedicated and configurable hardware, software tools, schedulers, code generators, and system-level design tools. Prerequisite: ELEN-427 or consent of instructor.

ELEN-622 Embedded Systems Design Laboratory **Credit 2(1-3)**
This laboratory course is an introduction to developing processor-based embedded systems. The development tools include a C++ cross compiler, an Electronically Programmable Read Only Memory (EPROM), and an Application Specific Integrated Circuit (ASIC) programmer. A student project is part of the laboratory requirements. Co-requisite: ELEN-621.

ELEN-623 Digital Systems **Credit 3(3-0)**
Digital system top-down design and analysis will be presented. Topics include timing, power and performance issues in digital circuits, Very High Speed Integrated Circuit Hardware Description Language (VHDL)-based system analysis and synthesis, hardware-software co-design, data-flow models, and digital system primitives. Prerequisites: ELEN-427 or consent of instructor.

ELEN-624 Computer Organization and Architecture Design **Credit 3(3-0)**
This course covers the design of modern uniprocessors and their memory, and Input/Output (I/O) subsystems. Performance, microarchitecture, and design philosophies used to realize pipeline, superscalar, Reduced Instruction

Set Computer (RISC) and Complete Instruction Set Computer (CISC) processors will be studied. Prerequisites: ELEN-427 or consent of instructor.

ELEN-629 VLSI Circuit Design **Credit 3(3-0)**

This course will study CMOS technology and device characteristics in order to develop layout design rules for VLSI circuit building blocks, such as inverters and logic gates. Layout techniques for complex gates and designing combinational and sequential logic circuits will be introduced. Prerequisite: ELEN-427 or consent of instructor.

ELEN-630 VLSI Design Laboratory **Credit 2(1-3)**

This is an introduction of Computer Aided Design (CAD) tools for integrated circuit design and verification. These CAD tools include; geometric pattern generators, design rule checkers, circuit simulators, and Programmable Logic Array (PLA) generators. A student design project is part of the laboratory requirements. Co-requisite: ELEN-629.

ELEN-647 Introduction to Telecommunication Networks **Credit 3(3-0)**

This course introduces telecommunication networks utilization and design. Emphasis is on using and designing voice, video and image digital networks. Prerequisite: ELEN-400 or consent of instructor.

ELEN-650 Digital Signal Processing I **Credit 3(3-0)**

This course develops a working knowledge of the basic signal processing functions, such as digital filtering spectral analysis, and detection/post-detection processing. Methods of generating the coefficients for digital filters will be derived. Alternate structures for filters, such as infinite impulse response and finite impulse response will be compared. Prerequisites: ELEN-400 or consent of instructor.

ELEN-651 Digital Signal Processing Laboratory **Credit 2(1-3)**

Experiments and student projects will be performed which are related to the practical applications of digital signal processing techniques to data acquisition, digital filtering, control, spectral analysis, and communications. Co-requisite: ELEN-650.

ELEN-656 Probability and Random Processes **Credit 3(3-0)**

This course covers sample space and events, conditional probabilities, independent events, Bayes formula, discrete random variables, expectation of random variables, joint distribution, conditional expectation, Markov chains, stationary processes, ergodicity, correlation and power spectrum of stationary processes, and Gaussian processes. Prerequisite: ELEN-400 or consent of instructor.

ELEN-657 Digital Image Processing **Credit 3(3-0)**

This course deals with concepts and techniques for digital image analysis and processing. Topics include image representation, image enhancement, edge extraction, image segmentation, geometric structure, feature extraction, knowledge representation, and image understanding. Prerequisite: ELEN-400 or consent of instructor.

ELEN-658 Digital Image Processing Laboratory **Credit 2(1-3)**

This laboratory course will demonstrate many important and practical applications of digital image processing techniques. The experiments include image enhancement, feature extraction, Hough transform, and various transforms in spatial and frequency domains, image understanding and quantization.
Co-requisite: ELEN- 657 or consent of instructor.

ELEN-661 Power Systems Analysis **Credit 3(3-0)**

The course studies power system representation, transmission lines, symmetrical and asymmetrical faults, electric power flow, power systems control and stability. Prerequisite: ELEN-430.

ELEN-662 Advanced Power Systems Laboratory **Credit 2(1-3)**

In this laboratory course, basic concepts, transmission lines, power flows, faults, and transient and steady-state stability will be investigated. Prerequisite: ELEN-436 or consent of instructor. Co-requisite: ELEN-661.

ELEN-668 Automatic Control Theory **Credit 3(3-0)**

This course introduces the theory of linear systems represented by state equations. Topics include Jordan canonical form, solutions to state equations, relationship to transfer functions, stability, controllability, and pole placement design. Prerequisite: ELEN-410 or consent of instructor.

ELEN-669 Control Laboratory **Credit 2(1-3)**

This laboratory course demonstrates methods of system identification and control. Verifications of control system designs in both the time domain and frequency domain will be studied. Co-requisite: ELEN-661.

ELEN-674 Genetic Algorithms **Credit 3(3-0)**
This course covers the theory and application of genetic algorithms. Genetic algorithms combine a Darwinian survival-of-the-fittest with a randomized, yet structured, information exchange to form an improved search mechanism with surprising robustness. Engineering applications of genetic algorithms for design and control will be presented. Prerequisite: ELEN-410 or consent of instructor.

ELEN-678 Introduction to Artificial Neural Networks **Credit 3(3-0)**
This course introduces neural network design and development. Emphasis is on designing and implementing information processing systems that autonomously develop operational capabilities in adaptive response to an information environment. Prerequisite: ELEN-400 or consent of instructor.

ELEN-679 Machine Intelligence Laboratory **Credit 2(1-3)**
This laboratory will explore the design and development of intelligent, autonomous, physical agents. An emphasis will be placed upon machine intelligence experiments with visual sensors, tactile sensors, robotic manipulators and autonomous inexpensive mobile robots. Prerequisite: ELEN-433 or consent of instructor. Co-requisite: ELEN-678.

ELEN-685 Selected Topics in Engineering **Credit 3(3-0)**
This lecture course is used to introduce engineering topics of current interest to students and faculty. The subject matter will be identified before the beginning of the course. Prerequisite: consent of instructor.

ELEN-686 Special Projects **Credit Var (1-3)**
This is an investigation of an engineering topic which is arranged between a student and a faculty advisor. Project topics may be analytical and/or experimental and should encourage independent study. Prerequisite: consent of instructor.

ELEN-701 Electronic Ceramics **Credit 3(3-0)**
This course introduces the properties of ceramic materials in electronic applications. The effects of processing parameters on the ultimate device characteristics will be investigated. Prerequisite: ELEN-602 or consent of instructor.

ELEN-710 Wave and Fields in Radio Frequency (RF) and Optoelectronics **Credit 3(3-0)**
This course emphasizes principles, phenomena and methods relevant to RF and lightwave technology. The topics will include basic electromagnetic propagation in free space and material media, guided electromagnetic waves, modes and mode coupling, and Bragg and other types of scattering. This course will establish the field principles of RF, integrated optic and fiber based devices and circuits. Prerequisite: ELEN-450 or ELEN-470 or consent of instructor.

ELEN-720 Theoretical Issues in Computer Engineering **Credit 3(3-0)**
This course is designed to introduce some basic theoretical aspects of computer engineering. It includes selected topics in the set theory, elements of algebra such as semigroups, monoids, groups, rings, and fields, quotient groups and homomorphism theorems. It also includes finite state machines, the Myhill-Nerode theory, pseudo/random generators, linear feed back registers, introduction to error correcting codes and Turing Machines. Various applications will be demonstrated. Prerequisite: ELEN-427 or consent of instructor.

ELEN-721 Fault-Tolerant Digital System Design **Credit 3(3-0)**
This course covers reliability, test generation, self checking techniques, principles and applications of fault-tolerant design techniques. Prerequisite: ELEN-625 or consent of instructor.

ELEN-723 System Design Using Programmable Logic Devices **Credit 3(3-0)**
This course will cover and compare many commercially available Programmable Logic Devices and consider their applications in both combinational and sequential logic system design. Students will also be familiarized with hardware description language such as VHDL and ABEL™ and shown how design ideas can be efficiently translated into programmable hardware implementations. Prerequisite: ELEN-623 or consent of instructor.

ELEN-724 Mixed-Signal VLSI Design **Credit 3(3-0)**
This course will introduce CMOS circuit techniques for low-power, low-voltage mixed-signal integrated circuits. Continuous-time signal processing, sampled-data analog filters, delta-sigma data converters, and mixed analog-digital layout techniques will be introduced. Prerequisite: ELEN-629 or consent of instructor.

ELEN-725 Pervasive Computing Systems **Credit 3(3-0)**
This course is a study of Pervasive Computing (a.k.a. Ubiquitous Computing) which is the integration of computer

technology into day-to-day life in a seamless manner. This course will address accepted design and implementation approaches relevant to this field, including those used for wearable computing, smart devices, intelligent environments, context aware computing, and user interfaces and interaction models. A course project will be assigned. Prerequisite: ELEN-621 or consent of instructor.

ELEN-727 Switching and Finite Automata Theory **Credit 3(3-0)**
This course presents the abstract mathematical modeling of combinational and sequential switching networks. Finite automata theory and fault tolerant concepts with applications to both combinational networks and finite state machines will be presented. Prerequisite: ELEN-427 or consent of instructor.

ELEN-749 Digital Communications **Credit 3(3-0)**
The fundamental theory and applications of the digital communications system are discussed based on the knowledge of the probability theory. Topics in digital communications include sampling, quantizing, coding, detection, modulation/ demodulation, signal-to-noise ratio, and error probability. Prerequisites: ELEN-449 or consent of instructor.

ELEN-752 Wireless Information Networks **Credit 3(3-0)**
Fundamental theory and applications of wireless mobile communication systems are covered for voice, data, and multimedia. Topics in wireless networks include characterization of radio propagation, source and channel coding, theory and analysis of wireless data networks, and wireless Local Area Networks (LANs). The wireless LANs discussion includes multiple access techniques and computer simulation of radio channels. Prerequisites: ELEN-452 or consent of instructor.

ELEN-762 Network Matrices and Graphs **Credit 3(3-0)**
Use of vector space techniques in the description, analysis and realization of networks modeled as matrices and graphs. The course investigates vector space concepts in the modeling and study of networks. The system concept of networks is introduced and explored as a dimensional space consideration in terms of matrices and graphs. Prerequisite: ELEN-400 or equivalent.

ELEN-764 Power System Planning **Credit 3(3-0)**
This course presents an overview of the issues and methods relevant to power systems planning. The course reviews the basics of financial analysis, regression analysis, forecasting, and reliability. Special topics relevant to power systems, such as deregulation, peak-load forecasts, load management and representation, and the loss-of-load probability (LOLP) method are also considered. Prerequisite: ELEN-661 or consent of instructor.

ELEN-785 Master Special Topics **Credit 3(3-0)**
This lecture course is used to introduce engineering topics of current interest to master students and faculty. The subject matter will be identified before the beginning of the course. Prerequisite: Consent of instructor.

ELEN-792 Master Seminar **Credit 1(1-0)**
Discussions and reports of subjects in electrical engineering and allied fields will be presented. Prerequisite: Master level standing.

ELEN-793 Master Supervised Teaching **Credit 3(0-3)**
Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment. Prerequisite: Master level standing.

ELEN-794 Master Supervised Research **Credit 3(0-3)**
This course is supervised research under the mentorship of a faculty member. It is not intended to serve as the project or thesis topic of the masters student. Prerequisite: Master level standing.

ELEN-796 Master Project **Credit 3(3-0)**
The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project, must be submitted for approval. This course is only available to project option students. Prerequisite: Masters standing and Consent of advisor.

ELEN-797 Master Thesis **Credit Var. (3-6)**
Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the Masters thesis. This course is only available to thesis option students. Prerequisite: Master standing and Consent of advisor.

ELEN-799 Master Thesis Continuation **Credit 1 (0-1)**
The course is for Master's students who have completed all required course works and all Master Project or Thesis credits. This optional course assists the student in maintaining full-time enrollment following completion of the Masters Project, ELEN796 or Masters Thesis, ELEN797. The course may be taken to allow time for the student to complete the final project or thesis write-up and to prepare for the masters project or thesis defense. Prerequisite: Completion of all required course works and master project or thesis credits for Master standing students and Consent of advisor.

ELEN-801 Solid State Devices **Credit 3(3-0)**
This course deals with p-n junction and Schottky barrier diodes, bipolar junction and field effect transistors, heterostructure devices (e.g., heterojunction bipolar transistors and solar cells), and device modeling and simulation. Prerequisite: ELEN-602 or consent of instructor.

ELEN-802 Advanced Solid State Theory **Credit 3(3-0)**
This course presents the physical properties of solids, including crystal lattice structure, atomic bonding, the band theory of electronic conduction, carrier mobilities, and scattering mechanisms. Prerequisite: ELEN-602 or consent of instructor.

ELEN-803 Compound Semiconductor Materials and Devices **Credit 3(3-0)**
This course presents the physics of compound semiconductors, epitaxial crystal growth, quantum well and superlattice devices, compound semiconductor FETs, and photonic devices. Prerequisite: ELEN-602 or consent of instructor.

ELEN-804 Semiconductor Material and Device Characterization **Credit 3(3-0)**
This course covers electrical, optical, and physical/chemical characterization of semiconductor materials and devices. Laboratory demonstrations will be presented on selected characterization techniques. Prerequisite: ELEN-602 or consent of instructor.

ELEN-805 Thin Film Technology for Device Fabrication **Credit 3(3-0)**
This course will focus on the preparation and properties of thin film electronic materials (dielectrics, metals, epitaxial layers). Topics will include: basic vacuum technology; theories of condensation, nucleation and growth of thin films; deposition techniques (chemical vapor deposition, vaporization, sputtering); epitaxial growth of semiconductor materials (molecular beam epitaxy, vapor phase epitaxy, liquid phase epitaxy); and applications of the deposition processes to the fabrication of heterostructure devices. Prerequisite: ELEN-602 or consent of instructor.

ELEN-810 Theory and Techniques in Photonics **Credit 3(3-0)**
This course will concentrate on photonic materials such as semiconductors and oxide materials for opto-electronic integrated optic and nonlinear optic guided wave devices such as lasers, modulators and fibers. The course will also cover photonic systems for computing, communications, sensing, and data acquisition, processing and storage. Prerequisites: ELEN-450 or ELEN-470 and ELEN-602.

ELEN-812 RF CMOS Integrated Circuits **Credit 3(2-3)**
This course covers the design of RF CMOS integrated circuits. Passive and active RF components and their modeling using modern CAD tools, high-frequency circuit design techniques, noise analysis and RF circuits such as low-noise amplifiers (LNA), mixers, voltage-controlled oscillators (VCO), power amplifiers, and wireless transceiver architectures will be presented. Prerequisite: ELEN-608 or consent of instructor.

ELEN-821 Advanced Computer Organization and Architecture **Credit 3(3-0)**
This course introduces the design and performance issues of array processors and multiprocessors. Very Long Instruction Word (VLIW), data-flow machines, array processors, interconnection networks, and memory structures will be discussed. Prerequisite: ELEN-624 or consent of instructor.

ELEN-822 Error-Correcting Codes **Credit 3(3-0)**
In this course, the basic principles of coding, such as error control schemes, coding in communication systems, and block coding, are studied. Linear block codes, polynomial algebra and cyclic codes, block codes based on finite field arithmetic, convolution codes, coding for bursty channels, coding for bandwidth limited channels, codes for computer memories and error detection and correction methods will be discussed. Prerequisite: ELEN-625.

ELEN-823 Advanced VLSI Design **Credit 3(3-0)**
This course introduces the design of very high performance digital circuits, interconnect modeling, and packaging. Timing issues in digital circuits, designing memory and array structures, reliability and yield predictions, design synthesis, and validation and testing of VLSI circuits will be discussed. Prerequisite: ELEN-629 or consent of instructor.

ELEN-847 Telecommunication Networks **Credit 3(3-0)**
The course familiarizes the student with the concepts of the International Standards Organization Open Systems Interconnection (ISO OSI) standards for the seven layer network model. This course introduces techniques for the analysis and optimization of computer networks, and illustrates some of the technical issues of current networks. Prerequisites: ELEN-647.

ELEN-848 Information Theory **Credit 3(3-0)**
This course covers topics in classical information theory such as entropy, source coding, channel coding, and rate distortion theory. Several related topics are discusses, including entropy for Markov sources and entropy for the extension of sources. Prerequisite: ELEN-749.

ELEN-849 Data Communications **Credit 3(3-0)**
This course is an extended study of digital communications. Various topics in the upper level of digital communications, such as channel coding, synchronization, multiplexing, multiple access, and frequency spreading are discussed. Prerequisite: ELEN-749 or consent of instructor.

ELEN-850 Digital Signal Processing II **Credit 3(3-0)**
This course deals with advanced topics in digital signal processing. Topics include the 2-D sampling theorem, the 2-D z-transform, the 2-D discrete Fourier transform, 2-D filters, and computational structures for the implementation of multi-dimensional digital signal processing algorithms. Prerequisite: ELEN-650 or consent of instructor.

ELEN-857 Pattern Recognition **Credit 3(3-0)**
This course covers classical topics in statistical decision function, Bayesian learning, error probability estimation, cluster-seeking, and deterministic approach. Several related topics are discussed, including stochastic approximation, feature selection and ranking, syntactic and structural pattern recognition. Prerequisite: ELEN-657.

ELEN-861 Power System Control and Protection **Credit 3(3-0)**
This course deals with power and voltage control systems, and power systems protection by relays. Related topics are also covered. Prerequisite: ELEN-661 or ELEN-668.

ELEN-862 Computer Methods in Power Systems **Credit 3(3-0)**
This course deals with commercially available software for modeling and analysis of electric power systems. Prerequisites: ELEN-661 or equivalent.

ELEN-865 Theory of Linear Systems **Credit 3(3-0)**
This course introduces modern control system design and analysis. Topics include linear-quadratic regulators, state estimators, and discrete-time control systems. Issues discussed include stability, robustness, and optimality. Prerequisites: ELEN-668 or equivalent.

ELEN-866 Discrete Time Systems **Credit 3(3-0)**
In this course, analyses and syntheses of discrete time systems are carried out using Z-transform and state variable representations. The controllability and observability, stability criteria, sampled spectral densities and correlation sequence, optimum filtering and control of random processes are discussed. Prerequisite: ELEN-668 or equivalent.

ELEN-867 Neural Networks Design **Credit 3(3-0)**
This course covers the design of neural network systems using CMAC (Cerebellum Model Articulation Controller), back propagation, and multifunction hybrid networks. Prerequisite: ELEN –678 or equivalent.

ELEN-868 Intelligent Methods for Control Systems **Credit 3(3-0)**
The course covers advanced control methods for dynamic systems. The focus will be on intelligent control algorithms, and adaptive and self-learning methods. Stability analysis and performance simulation will also be addressed. Prerequisite: ELEN –668 or consent of instructor.

ELEN-869 Machine Vision for Intelligent-Robotics **Credit 3(3-0)**
This course is a study of visual/non-visual sensor technologies for the intelligent control of a robot. The course will

cover image understanding, non-contact sensor analysis, and data fusion for intelligent robotics system design. Prerequisite: ELEN-657.

ELEN-870 Fuzzy Logic with Applications **Credit 3(3-0)**

The course objective is to understand the basic theory and the foundations of fuzzy sets. Fuzzy logic is shown to contain evidence, possibility, and probability logic. This course emphasizes engineering applications in control, decisions-making, and pattern recognition. The hardware/software implementation of those applications is also demonstrated. Prerequisite: ELEN –668 or consent of instructor.

ELEN-871 Nonlinear Control Systems **Credit 3(3-0)**

This course explores the basic issues of nonlinear system analysis and control. The course will introduce the general characteristics of nonlinear behavior and some of the tools needed to analyze and understand them. It will also introduce basic concepts of stability theory, especially Lyaunov's. Some basic design techniques for the control of these systems, such as the sliding mode method and feedback linearization, will be introduced. Prerequisite: ELEN –668 or consent of instructor.

ELEN-885 Doctoral Special Topics **Credit 3(3-0)**

This lecture course is used to introduce engineering topics of current interest to doctoral students and faculty. The subject matter will be identified before the beginning of the course. Prerequisite: Doctoral student and consent of instructor.

ELEN-991 Doctoral Qualifying Examination **Credit 3(0-3)**

This course is for students who are preparing for and taking the written qualifying examination. Prerequisite: Doctoral student and consent of advisor.

ELEN-992 Doctoral Seminar **Credit 1(0-1)**

In this course, doctoral students attend colloquia or seminars. These consist of presentations by doctoral students on dissertation topics and works-in-progress and by guests on important classical, contemporary, or research problems in electrical engineering. Prerequisite: Doctoral level standing.

ELEN-993 Doctoral Supervised Teaching **Credit 3(0-3)**

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment. Prerequisite: Doctoral level standing.

ELEN-994 Doctoral Supervised Research **Credit 3(0-3)**

This is supervised research under the mentorship of a member of the graduate faculty. It is not intended to serve as the dissertation topic of the doctoral student. Prerequisite: Doctoral level standing and consent of instructor.

ELEN-995 Doctoral Preliminary Examination **Credit 3(0-3)**

This course is for students who are preparing for and taking the written and/oral preliminary examination. Prerequisite: Doctoral student and consent of advisor.

ELEN-997 Doctoral Dissertation **Credit Var. (3-12)**

This supervised research serves as the dissertation of the doctoral student. Twelve credits of dissertation are required for graduation. Prerequisite: Doctoral student and consent of advisor.

ELEN-999 Doctoral Dissertation Continuation **Credit 1 (0-1)**

The course is for doctoral students who have completed all required course works and all dissertation credits. This optional course assists the student in maintaining full-time enrollment following completion of the Doctoral Dissertation, ELEN997. The course may be taken to allow time for the student to complete the dissertation write-up and to prepare for the dissertation defense. Prerequisite: Completion of all required course works and dissertation credits for Doctoral student and Consent of advisor.

10. SPECIAL CONSIDERATIONS

10.1. TRANSFER OF CREDIT

A maximum of six semester hours of graduate credit may be transferred from another graduate institution if they are not part of any prior undergraduate degree requirements. Transfer credit must be at the graduate level in the university where the work was completed. Credits to be transferred must be approved by the student's advisor according to their appropriate nature in the student's curriculum. Only the permanent advisor of the student may recommend a transfer of credit to the department chairman by submitting a letter indicating courses, credit hours and justification and the Graduate Plan of Study for the student's degree program. The chair of the Electrical and Computer Engineering Department may then send a form of "Request Transfer of Graduate Credit" to the Graduate School.

10.2. TIME LIMITATION

The student must complete his/her master program within six successive calendar years. The doctoral student has a maximum of six calendar years from admission to attain candidacy and ten calendar years to complete all requirements. A dissertation must be completed in no more than five years after entering into candidacy. Programs remaining incomplete after this time interval are subject to cancellation, revision, or special examination for out-dated work. When the program of study is interrupted because the student has been drafted into the armed services, the limit shall be extended for the length of time the student is on active duty, if the candidate resumes graduate work no later than one year following his/her release from military service.

10.3. GRADUATE STUDENT FUNDING

Financial assistance provided to graduate students has as its objective fair compensation for work and/or a supporting level of subsistence while the student attends graduate school and diligently pursues his or her graduate program. In order to be fair to all students requesting assistance, the following policies and/or guidelines are in effect.

- To be considered for financial assistance, the graduate student must be enrolled in courses which are applicable to, and on the student's degree program. In the event the degree plan has not been established, the courses must be approved by the student's advisor and Graduate Coordinator.
- A request for financial assistance must be on file at least 30 days prior to the time the assistance is requested. In the event of late filing, there is a strong possibility that funding will not be possible due to a limitation of funds.
- All funding decisions are normally made prior to the completion of registration and each student is notified of both consideration and final appointment.
- Funding becomes effective when it is established that the student is available, assigned to work, enrolled in the graduate program, and diligently pursuing graduate studies.
- Funding and work assignments follow the guidelines below:

If a student is assigned a work load less than	The student must enroll in	
	at least	no more than
20 hrs/wk	3 hrs	12 hrs
30 hrs/wk	3 hrs	9 hrs
40 hrs/wk	1 hr	6 hrs

These hours represent semester hours of study, which are either applicable to the Plan of Study or are approved by the student's advisor and the Graduate Coordinator.

- Funding provided by Fellowships, the Graduate School, College, and other sources not under the administration of the Department of Electrical and Computer Engineering is governed by the policies, procedures, and guidelines of the applicable funding source.

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

Department of Electrical and Computer Engineering

PLAN OF GRADUATE STUDY

Original Plan( ), Revised Plan( ) Date _____

Last Name	First Name	M.I.	Student ID

Campus Address	Phone	Email

Degree Sought: M.S.( ) Ph.D.( ) **Date Expected:** _____

Master's Option

Check One	X	Total Credit Hours Required	Coursework	Seminar ELEN-792	Project ELEN-796	Thesis ELEN-797
Course Only						
Project						
Thesis						

Doctoral

Total Hours Required	Coursework	Seminar ELEN992	Qualifying ELEN-991	Preliminary ELEN-995	Dissertation ELEN-997

Advisory Committee

Committee Members	Signature

GRADUATE COURSES COMPLETED AT OTHER INSTITUTIONS FOR WHICH TRANSFER CREDIT IS REQUESTED TOWARD DEGREE

Institution	Course Number and Title	Date	Credits	Grade

* To officially transfer credits, a Transfer of Credit form must be completed and approved by the program and the School of Graduate Studies.

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

Department of Electrical and Computer Engineering

PLAN OF GRADUATE STUDY

Last Name	First Name	M.I.	Student ID

GRADUATE WORK PROPOSED

Course #	Course Title	Credits	Term	Grade
Total Credit Hours				

_____

Student's Signature

Approved by Advisor: _____ _____

Type or Print *Signature*

Approved by Graduate Coordinator: ***Dr. Jung H. Kim*** _____

Type or Print *Signature*

Approved _____

Graduate School

* *Each graduate student must file this plan in the department office and the School of Graduate Studies before completion of the second semester in his or her program. Since ELEN-685, 785 and 885 are the experimental courses being used to develop new courses, the topics of these courses must be included. For the Ph.D. coursework requirement, 600 level courses are not counted except for the 600 courses listed in the Qualifying Examination subjects. In addition, no pass/fail courses are counted in the coursework requirement.*

Application for Qualifying Examination

Please print or type

Name:_____ SID:_____

Date of Entry into Program: _____ GPA: _____

Major Area Concentrated: _____

Only unconditionally admitted students with a cumulative GPA of 3.0 or better are eligible to take the Qualifying Examination for the doctoral program. Each student must submit a copy of the approved Plan of Graduate Study along with this application form to the Department of Electrical and Computer Engineering.

Selection of Subjects: (The student must select only two major subjects in the student's major concentration area, and two additional subjects from other areas among the subjects S1 through S13 in the ECE Graduate Student Handbook. Pease type "S" numbers for your selection.)

(1)	(2)	(3)	(4)

Student_____
Signature

Academic Advisor_____
Type or print

_____
Signature

Graduate Coordinator_____ Dr. Jung H. Kim _____
Type or print

_____
Signature

Department Chair_____ Dr. John C. Kelly _____
Type or print

_____
Signature

This form must be submitted to the Electrical and Computer Engineering Department Office by the application deadline announced at the beginning of each semester. Completed forms must be signed by the student's advisor, Graduate Coordinator and the department Chairperson.

Form GCD-2 (8/1/2007)

Request for Thesis/Dissertation Topic Approval

This document must be prepared by the student at prior to enrolling in M.S. thesis or Ph.D. dissertation credit. This form is not acceptable without all appropriate signatures.

Degree Sought: ☐ M.S. ☐ Ph.D.

Thesis Title: _____

_____

Abstract
The abstract is composed of a one paragraph description of the problem to be examined and the expected outcome of the thesis/dissertation research.

Problem Statement
This section states the problem statement and the research content. It limits to one page in length.

Background
Relevant issues and previous works are summarized in this section. This section should be no longer than four pages.

Analytical and/or Experimental Procedures
This section describes the methods and experiments to be used in addressing the problem statement research in one page or less.

Expected Results
This section describes, in one page or less, the major expected results and the anticipated impact the research will have on the state of human knowledge.

Student	_____ Type or print	_____ Signature	_____ date
Academic Advisor	_____ Type or print	_____ Signature	_____ date
Committee Members	_____ Type or print	_____ Signature	_____ date
	_____ Type or print	_____ Signature	_____ date
	_____ Type or print	_____ Signature	_____ date
	_____ Type or print	_____ Signature	_____ date

Form GCD-3 (8/1/2007)

Application for Oral Examination

Degree Sought: ☐ M.S. ☐ Ph.D. Today's Date:_____

Program Option: (M.S. Degree Only) ☐ Thesis ☐ Project Oral Examination: (Ph.D. Degree Only) ☐ Preliminary ☐ Final

Print or type

Name:_____ SID:_____

Title:_____

_____

Presentation: Date: _____ Time:_____

Location: _____

Signatures/dates

Academic Advisor: _____ (Type or print) _____ (Signature) date

Committee Members: _____ (Type or print) _____ (Signature) date

_____ (Type or print) _____ (Signature) date

_____ (Type or print) _____ (Signature) date

_____ (Type or print) _____ (Signature) date

Graduate Coordinator: _____ (Type or print) _____ (Signature) date

This form must be submitted to the Electrical and Computer Engineering Department Office, all committee members and the Graduate Coordinator with all required signatures before the date of presentation.

Form GCD-4 (8/1/2007)

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY
ELECTRICAL AND COMPUTER ENGINEERING

RESULTS OF ORAL EXAMINATION

Degree Sought: ☐ M.S. ☐ Ph.D. Date of Examination:_____

Program Option: (M.S. Degree Only) ☐ Thesis ☐ Project Oral Examination: (Ph.D. Degree Only) ☐ Preliminary ☐ Final

Name:_____ SID:_____

Title:_____

_____

RESULTS: ☐ _____ has successfully passed the oral examination.
(Student's name)

☐ _____ has failed the oral examination.
(Student's name)

Signatures/dates

Academic Advisor: _____ _____
Type or print Signature date

Committee Members: _____ _____
Type or print Signature date

_____ _____
Type or print Signature date

_____ _____
Type or print Signature date

_____ _____
Type or print Signature date

Graduate Coordinator: _____ _____
Type or print Signature date

***NOTE**: The Committee Chair must submit this form to the Department Office and the Graduate within 48 hours after the oral examination.*

Form GCD-5 (8/1/2007)

Application for Graduate Assistantship

Type or print or type

Name: _____ SID: _____

Address: _____

_____

Phone: _____ Email Address: _____

Date Admitted to Current Graduate Program: _____

Program: ☐ M.S. ☐ Ph.D. Program Option: (M.S. Program Only) ☐ Thesis ☐ Project ☐ Course-only

Date of Birth: _____ US Citizen or Permanent Resident: ☐ Yes ☐ No
Month Day Year

Type of Assistantship desired: TA( ) RA( ) Fellowship( ) Either( )

Teaching Assistantships generally entail teaching of lower level courses or grading homework assignments. Duties may also include tutoring or holding problem sessions for students or conducting laboratory experiments or related duties for approximately 15 to 20 hour per week for the duration of the assistantship period. The assistant is expected to possess (1) the necessary proficiency with subject matter, (2) suitable oral and written English communication skills, and (3) the willingness and dedication in the opinion of his or her supervisor to adequately perform the specific duties of any offer.

Research Assistantships generally entail working with a research staff member in engineering on a research investigation of a scholarly nature. The assistant may be expected to search for pertinent literature, and read and understand related topical literature. He or she may be directed to study topics of an analytical or experimental nature, contribute to technical reports and publications and to program a digital computer. Normally about 15-20 hours per week is expected for such assistants. Research assistants are expected to be reasonably competent in the research subject and must display an interest in and willingness to learn additional material on the subject. Further, the assistant must be reasonably conversant in the English language. Research assistantships are the result of sponsorship of faculty research proposals. Accordingly, students who receive a research assistantship are expected to meet performance goals set by the principal investigator in conjunction with the funding agency. Students failing to achieve satisfactory results will not be considered for continuing or alternate graduate support.

Graduate Fellowships are given through outside funding support. A number of different guidelines apply, and the student acquiring a fellowship should clearly understand all conditions and requirements.

Educational Background at the University Level:

Universities Attended	Dates Attended	Degree Awarded
1.		
2.		
3.		

Are you able to communicate well orally in English? Yes ( ) No ( )
Do you have a good knowledge of written English? Yes ( ) No ( )

List any prior work experiences which you feel helps qualify you for an assistantship. You may wish to include information on prior teaching or research involvement. Attach extra sheets if needed.

_____

_____

_____

List three references with addresses and phone numbers who can vouch for your qualifications to be an assistant.

1. _____

_____

2. _____

_____

3. _____

_____

Do you have any special handicap, medical or otherwise, which would impair your functioning as an assistant? Yes ( ) No ( )
If yes, please explain, and attach additional information if needed.

_____

List your specialization interests below.

( ) Communications and Signal Processing ( ) Computer Engineering

( ) Electronic Materials and Devices ( ) Power Systems and Controls

( ) Other (list below)

_____

FOR OFFICE USE ONLY

Academic Advisor _____

Type of Assistantship Granted _____

Research/Teaching _____ Amt. per Month_____

Duration: _____
From To

Thesis/ Project and Dissertation Proposal Guide

This document is very helpful in focusing the student's efforts. It also requires that the student's committee be formed early, thereby providing an opportunity for constructive interaction in the research effort.

[Descriptive title of research topic]

[Name, department and Advisor]

Abstract

The abstract should be a one paragraph description of the salient points covered in the proposal. The abstract must be well written. Students should get to the point immediately and include a sentence or two that summarizes each of the major sections of their proposal.

Introduction

This section should state the goal of the research. It should give enough background to orient the reader, while not becoming mired in details. This section includes: (a) Problem statement – including motivation, why the research is important for society and/or technology and so forth, (b) Literature survey – including history and current status of the relevant research, (c) Purpose and goal – including research scope, and (d) The idea(s) for tackling the problem presented.

Background

In this section, a few of the relevant issues that have been previously explored are summarized. The information gleaned during your initial literature search will be summarized here. This section includes: (a) Details of the current solution for the research problem and the current status of the research, (b) A definition of the notations and variables to be used, (c) A description of the mathematical and graphical tools to be used, and (d) An exposition of the basic mathematics to be used in the study, methodology and algorithms.

Methodology and Algorithms

Algorithms and methodology to be used in the research are explored and developed in this section. This section is the main body of the work and includes: (a) Details of the proposed own idea to solve the problem, (b) Mathematical modeling of the problem, (c) Algorithm description of the idea proposed – mathematically, (d) Mathematic modification including theorems and proofs, (e) Details of the solution using mathematical proof, and (f) Details of the contribution of the proved solution.

Experimental and Results

This section is similar to a lab report. The equipment to be used, the data gathering procedure and how that data will be manipulated or processed is described. This section includes: (a) Software and/or hardware implementation of the methodology and algorithm proposed, (b) Several kind of experiments (or simulation) to show how the idea works including several demos, (c) Details of the numeric values of the experiments or a simulation to show how significant the solution is for solving the research problem, (d) Comparison with other methods or algorithms to show the superiority of the chosen methods and algorithm including tables, graphs and plots, and (e) An analytical description of the results.

Conclusion

Using the success criteria described in the above sections, this section addresses the impact and contribution of the research. This section includes: (a) A summary of the student's work, (b) Contribution and significance of the student's work, and (c) Potential future investigation, including a description of their direction(s).

Bibliography

This section lists all references used in the proposal as a result of the literature search. Each reference must be numbered in order, and the numbers must appear in the sentences where they are referenced.

NOTE: