# Table of Contents

I. Administration 3  
II. Admissions 7  
III. Registration and Other Academic Policies 9  
IV. Master of Science in Electrical Engineering 15  
V. Master of Science in Computer Engineering 21  
VI. Master of Science in Telecommunications 24  
VII. Master of Science in Power & Energy Systems 27  
VIII. Doctoral Study in Electrical & Computer Engineering 29  
IX. Doctor of Philosophy in Electrical Engineering 31  
X. Doctor of Philosophy in Computer Engineering 35  
XI. Faculty Research Area/Interests 39  

ECE Department and Graduate Studies Forms 42
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Introduction

We are pleased to present our *Handbook for Graduate Students* for students enrolled in programs in the Department of Electrical and Computer Engineering (ECE). This document is a compilation of both Institute and ECE Department regulations and procedures of particular interest to M.S. and Ph.D. students. Please note that the Institute’s *Graduate Catalog* also contains information you will find helpful. Changes that may occur in ECE Department procedures will be posted on the bulletin board near 200 ECEC. We expect to revise this handbook on an annual basis.

Graduate degrees offered by the Department of Electrical and Computer Engineering.

- MS in Computer Engineering
- MS in Electrical Engineering
- MS in Telecommunications
- BS in Power and Energy Systems
- Ph.D. in Computer Engineering
- Ph.D. in Electrical Engineering
II. ADMISSIONS

The following sections contain special admission issues of concern to students in the Department of Electrical and Computer Engineering. Please consult the Graduate Catalog for other issues regarding admission.

1. GRE and TOEFL

The Graduate Record Examination (GRE) General Section is required of all applicants to doctoral programs, all full-time applicants to master’s programs, all applicants seeking financial support, and all applicants whose most recent degree was awarded from an institution outside of the United States. Typical GRE scores for MS programs are: (V≥144, Q≥155).

TOEFL is required for all international students applying to a graduate program, the score of which must be at least 79 (Internet Based), 550 (Paper Based) or 213 (Computer Based) or 6.5 IELTS. Applicants with scores below these numbers are not considered for admission.

2. Conditional Admission

Conditional admission may be granted to applicants who do not have the appropriate academic background required for a particular degree program, but who have an academic record that meets NJIT’s scholastic standards. Once granted conditional admission students must complete conditional or bridge courses specified by the university within their first two semesters. Such courses may be at either the undergraduate or graduate level and are NOT counted as degree credits, although all graduate courses are calculated in the grade point average (GPA). Students must attain grades specified by the University and are not permitted to take more than 9 credits that count as graduate degree credits at NJIT before meeting the terms of conditional admission. Failure to meet these conditions may result in dismissal from the University.

3. Change of Major

Students are admitted to one graduate degree program and not to the University as a whole. Students who wish to change majors must remain and take courses in the original program for a year and then file an application for admission to the new program. There is no guarantee that the new application will be successful. Those on support may risk losing support from the original department and cancellation of a current award. International students and others who must be registered full-time will still be required to have a 12-credit registration.

4. Change of Degree Level

Students who wish to change the level of the degree program in which they are enrolled must file an application for admission to the new degree level. There is no guarantee that the application will be successful. Students who wish to drop down to a master’s degree program from a doctoral program should be aware of the impact of this action on current and future financial support.

5. Textbooks

New students should contact the NJIT bookstore for text book information and instructional materials.
6. Non-Degree (Non-Matriculated) Students

Non-matriculated students may be permitted to take a maximum of 9 graduate-level credits over three registration periods, except students seeking a graduate certificate. These students may take a maximum of 12 graduate-level credits over four registration periods. Students wishing to take credits beyond these limits must apply and be accepted to a degree program as a matriculated student. Academically qualified students who do not desire to enter degree programs may enroll for certain individual graduate courses. Such students must present transcripts of previous academic work or other appropriate evidence at each registration in order to indicate adequate preparation for the course work involved. If approved by the Associate Chair for Graduate Studies and by the Office of University Admissions, registration will be permitted if space is available. Permission to enroll as a non-matriculated student does not imply eventual admission to a degree program.

7. Graduate Certificate Programs

NJIT offers clusters of courses in concentrated areas for students who wish to obtain a certificate of completion. In general, these require completion of 12 credits at the graduate level. Students in these programs are considered to be non-matriculated students for the duration of the certificate program.

Upon completion of the certificate program, the student may apply for admission to matriculated status. In the event that the petition is approved, some or all of the courses taken in the certificate may be applied toward satisfying the M.S. degree requirements. The courses must be applicable to the M.S., and the grade in each accepted course must be B or better.
III. REGISTRATION AND OTHER ACADEMIC POLICIES

1. Approval of Course of Study

Students are required to arrange a conference with their graduate advisor as soon as possible after notification of admission (international students should do so immediately after arrival in the United States) to formulate a course of study that meets the requirements of the particular degree program and reflects the interests and aspirations of the individual student. New students are required to attend the department orientation for new students and obtain advisor approval for initial course registration.

2. Continuous Registration Requirement

Once admitted to a degree program, students must be continuously registered each semester until they complete degree requirements. Students are not permitted to register for Maintaining Registration (MR) if their project, thesis or dissertation is unfinished without approval for a Leave of Absence by the Dean of Graduate Studies. Students who complete work for Master’s Projects or Theses over several semesters receive a final grade (A, B, C) in the semester in which the work is completed and the final document is approved. The final grade of a completed doctoral dissertation is P. An interim grade of S or U is given for semesters other than the final semester.

3. Transfer of Credits from Outside NJIT

Transfer credits are calculated by NJIT according to the total number of instructional minutes earned at the other institution. The equivalent instructional minutes of a maximum of 9 credits of graduate work, taken within seven years, from accredited U.S. educational institutions may be transferred and applied to degree requirements at NJIT. Credits from educational institutions outside the United States cannot be transferred. On a case by case basis, up to 9 credits may be waived for non-collegiate based instruction. The university does not grant transfer credit for work experience or other non-instructional activities. Credits are transferred only if the courses were taken for full academic credit, were never applied to any other degree, and a final grade of at least B was attained. In addition, the student’s graduate advisor and the Office of Graduate Studies must agree that such courses directly relate to the student’s program of study before they can be transferred.

Requests for transfer credit must be submitted on a form available from the Office of Graduate Studies, accompanied by course descriptions from the other educational institution. Students must also arrange for the other institution to send an official transcript to the Office of Graduate Studies at NJIT. Requests may be submitted and approved at any time but are not added to a student’s record until matriculation is granted. Grades that are transferred will not be calculated in cumulative grade point averages.

4. Enrollment Status

Full-time Students: Students registered for 9 credits or more throughout an entire semester are considered full-time. International students and students receiving financial awards must have full-time status each semester.

Part-Time Students: Students registered for fewer than 9 credits during a semester, unless certified as full-time by the Office of Graduate Studies.
5. Full-time Certification

Graduate students must be registered for not less than 9 credits each semester in order to be accorded full-time status. The Office of Graduate Studies may certify certain students as full-time even if they are not registered for 9 credits, as follows:

- Students who have fewer than 9 credits remaining for completion of all degree requirements and are registered for all credits needed to complete the degree. This certification can only be given for one semester.

- Doctoral students preparing for qualifying examinations or research proposal presentations register for at least 6 credits. Course credit possibly includes 3 credits of pre-doctoral research.

- Doctoral candidates who have completed all course work, other degree and credit requirements, and who are registered in Dissertation Research and Seminar for at least 3 credits each semester.

- Students who originally registered for 9 credits but now have substantial extenuating circumstances requiring a reduction in course load. Normally this certification applies only in cases of medical or similar emergencies which incapacitate a student for a significant part of a semester. Improper course registration, failure to seek proper advisement, inadequate academic progress, or risk of earning a weak or failing grade are not extenuating circumstances.

- Students on a full-time cooperative education assignment and registered in the Co-op Work Experience or equivalent course. When students are in their final semester of study, they may be certified as full-time and approved for co-op. The Office of Graduate Studies should be consulted for limits on cooperative education, as it has an impact on full-time certification and allowable time to complete the degree.

Audited courses and withdrawn courses do not count toward full-time status; ESL (English as a Second Language) courses do count as one course.

6. Grade Point Average Calculation

In order to obtain a graduate degree, candidates must have a cumulative grade point average of at least 3.0 in all graduate-level courses, exclusive of grades in Master’s Project or Master’s Thesis. All 500-level or higher courses are included in the cumulative grade point average, regardless of applicability to a specific degree. Only the initial grades for graduate courses that have been repeated once are excluded from GPA calculations. In addition, the cumulative grade point average for all courses counted for the degree, exclusive of Master’s Project or Master’s Thesis, must be 3.0 or better.

7. Expiration of Credit

For all degrees, credits expire seven years after completion of the semester in which they are earned. Expired courses cannot be used to fulfill degree requirements and must be replaced by current credits. Degree requirements must be completed within seven consecutive years of original admission. Approved leaves of absence do not count against the seven-year limit for completion of the degree although the validity of individual courses may still expire during this time. Requests for waivers of the seven-year limit for extenuating circumstances, other than mere failure to register, are made to the Dean of Graduate Studies. The technical content and remaining currency of courses are considered in evaluating these requests.
8. Grades

The Registrar issues a grade report to each student at the end of each semester. Grade point averages are calculated for each semester and cumulatively for the entire graduate record. Undergraduate credits taken by graduate students are not counted. The following grades are used:

<table>
<thead>
<tr>
<th>Grade</th>
<th>GPA</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.0</td>
<td>Excellent</td>
</tr>
<tr>
<td>B+</td>
<td>3.5</td>
<td>Good</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
<td>Acceptable</td>
</tr>
<tr>
<td>C+</td>
<td>2.5</td>
<td>Fair</td>
</tr>
<tr>
<td>C</td>
<td>2.0</td>
<td>Minimum Performance</td>
</tr>
<tr>
<td>F</td>
<td>0.0</td>
<td>Failure</td>
</tr>
<tr>
<td>I</td>
<td></td>
<td>Incomplete</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td>Approved Withdrawal</td>
</tr>
<tr>
<td>AUD</td>
<td></td>
<td>Audited (No academic credit)</td>
</tr>
<tr>
<td>S or U</td>
<td></td>
<td>Satisfactory or Unsatisfactory (interim grades for thesis and dissertation and final grade for Co-op)</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Passing a Master’s Thesis or Passing for Doctoral Dissertation and Defense</td>
</tr>
</tbody>
</table>

9. Incomplete Grades

A grade of I (Incomplete) is given when courses cannot be completed because of special circumstances. Students on academic probation are not permitted incompletes without permission from the Office of Graduate Studies. Required course work may be finished at the discretion of the instructor, no later than the end of the subsequent semester. A letter grade must be assigned or a grade of “F” will be given. Students nominated for financial awards must have I grades resolved by the fourth week of the subsequent semester to allow a determination of their eligibility for the award. This grade cannot be changed. A grade of “I” cannot be given for thesis, project, dissertation, seminar, pre-doctoral research courses, or ESL courses.

10. Course Withdrawals

Withdrawal from graduate courses, without academic penalty, is permitted until the end of the ninth week of the semester. A notation of W on the student’s transcript signifies an approved withdrawal. Withdrawal forms may be obtained from the Office of the Registrar. Approved withdrawal takes effect when the Registrar receives the completed withdrawal form from the student within the designated nine-week period. A failing grade will be issued to students who do not notify the Registrar of withdrawal in this manner. Students who do not obtain an approved withdrawal are obligated to pay full tuition and fees. Any refunds for approved withdrawals follow the refund schedule established by the Registrar. Withdrawals that affect conditions for retention of financial awards or support, continued full-time status, academic probation, progress toward a degree, admission, ESL, or participation in special programs must be approved by the Office of Graduate Studies. After the ninth week of the semester, students may withdraw from a course only for extenuating circumstances with the approval of the Dean of Graduate Studies and by the graduate program advisor.
11. Auditing a Course

Students who wish to audit a course must state their intention to do so at the time of registration. Change in auditing status is not permitted once a semester has begun. Students who audit are required to pay full tuition and fees for the course. Financial awards are not applicable to audited courses. Audited courses are not counted in determining full-time status. Students on probation are not permitted to audit.

12. Cross-Listing of Courses

Several courses are cross-listed with the Computer Science Department. Students will get credit for only one course not for both the courses. Examples are: ECE 683/CS 652, ECE 638/CS 696 and ECE 637/CS 656. Students will get credit for either for ECE 683 or for CS 652 but not for both. Similarly, credits will be given either for ECE 637 or CS 656 but not for both. Limitation of outside department courses also applies to cross-listed courses.

13. Satisfactory and Unsatisfactory

The grades S or U report progress in project, thesis, dissertation, and pre-doctoral research courses. These also can be final grades in seminar, co-op, teaching methods, and ESL courses. The grade of S is given for satisfactory progress and U is given for unsatisfactory progress. Students who fail to meet with their advisors will receive a U grade. Credits for courses in which U is received cannot count toward a degree.

14. Course Repetition

Graduate students may request approval to repeat a course using a form available from the Office of Graduate Studies. The grade received in a repeated course is calculated in the cumulative grade point average, but the first grade still appears on the transcript. A maximum of two courses may be repeated in graduate studies. Students may not repeat a course without prior approval from the department and the Office of Graduate Studies. Students who receive an F in a course will be required to repeat that course. The Dean of Graduate Studies should be consulted if the course is no longer offered or not applicable to the student’s current program.

15. Study Plan

MS students are required to fill up their study plans, available in ECE department office and in the program websites, for different programs in the beginning and update them during subsequent registration cycles for removal of registration holds. Doctoral students need to complete their progress report form and submit it in the department office for registration hold removal.

16. Project, Thesis and Dissertation

Theses and dissertations submitted for graduate degrees must follow a prescribed format. A manual outlining the university requirements for thesis and dissertation submission is available in NJIT’s bookstore. The Office of Graduate Studies should be consulted for more information.

Letter grades are given for satisfactory completion of the Master’s Project, and P is used as a final grade after successful defense of the Master’s thesis. Projects and theses must be submitted first, before a grade can be given. Theses and dissertations are submitted to the Office of Graduate Studies. Projects are...
submitted to the project graduate advisor. Semester and cumulative GPA calculations by the Registrar only include courses for which a letter grade is given. For the purpose of the GPA, the Registrar only calculates the grades for credits earned in the semester in which the project is completed. Letter grades cannot be given for an unfinished project or thesis, nor for work not submitted. A grade of P is given for satisfactory completion of a doctoral dissertation and defense. Receipt of two U grades for project, thesis, dissertation, or pre-doctoral research will result in a letter grade of F in place of the second U and dismissal from the program. Students may not register for project, thesis, or dissertation credits until they arrange for a department- or program-approved faculty advisor to supervise the work. Continued registration for additional thesis, project, or dissertation credits will be allowed as long as the advisor grades the work to show that there is satisfactory progress. Credits for which a U (unsatisfactory) grade is given are not counted as degree credits toward completion of the thesis, project, or dissertation.

Master’s project or master’s thesis registration must be at least 3 credits during a semester or summer session. Doctoral dissertation registration must be at least 6 credits during a semester, until the 36-credit requirement is reached, at which time 3-credit registrations are permitted. All students must have their advisor’s signature and section identification each time they register for project or thesis. Students must register for thesis, project, or dissertation work within the deadlines established by the Registrar. Doctoral dissertation registration may be 3 credits during a summer session. Maximum credit registration each semester is 12 credits for the doctoral dissertation, 6 credits for the master’s thesis, and 3 credits for the master’s project. Once a student has begun the master’s project, the master’s thesis, or the doctoral dissertation, he or she must register for these courses each semester until the project, thesis, or dissertation is completed. Unapproved interruptions in project, thesis or dissertation may be subject to billing for omitted credits. Students must be registered in project, thesis or dissertation in any semester or summer session in which completion is expected. A final grade is assigned by the advisor for thesis or dissertation when the Office of Graduate Studies confirms it has received all documents in final and approved form and all related bills have been paid.

Approval by the graduate program advisor and the Office of Graduate Studies must be obtained if the student wishes to interrupt the thesis, project, or dissertation for a semester or more. Students must maintain continuity of registration for theses and dissertations (implies registration for fall or spring, but not for summer). If a master’s project is not completed after two semesters of registration, a final grade of F is given. Failure to complete a master’s project by students who receive financial support may result in dismissal. No more than four semesters and two summers of registration for a master’s thesis are permitted. Failure to complete a master’s thesis within this period will result in a final grade of F, and may result in dismissal. No more than six years of registration for doctoral dissertation is permitted. Failure to complete a doctoral dissertation in this period will result in a final grade of F and dismissal from the program.

Students who require additional time to complete a project, thesis, or dissertation should appeal for an extension, in writing, to the graduate program advisor, the department, and the Office of Graduate Studies. If the appeal for an extension is denied, the student may appeal further in the following order: department chairperson, dean of the school or college, and finally to the Committee on Graduate Appeals. Appeals may be accompanied by any material that the student believes appropriate. Appeals to the Committee on Graduate Appeals should be directed to the Dean of Graduate Studies. All decisions of the Committee on Graduate Appeals are final.
17. Deadline Waiver

Applications for January or May graduation for students whose master’s thesis or doctoral dissertation is substantially complete, but who are unable to submit it in final form by the specified date, may request a deadline waiver from the Office of Graduate Studies before it is due. Students granted a waiver may be permitted until a date specified by the Office of Graduate Studies to submit the final copy of the work. Such students may then apply for the next scheduled graduation without having to pay for additional thesis or doctoral dissertation credits. Contact the Office of Graduate Studies for further information.

18. Academic Advisement

If, after proper review of this document a student has any further questions they need to consult with the academic advisers. This applies to students with the non-thesis option and students before being assigned to a thesis adviser. Any advisement received from any outside source or from senior students may put the students in a disadvantageous position in terms of graduation or appropriate degree requirements.
IV. MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

1. Admission Requirements

Applicants are expected to have excellent undergraduate backgrounds in physics, mathematics (through differential equations and vector analysis), electrical networks and devices, electronics, analysis and design methods, transients, electromagnetic fields, and appropriate laboratory work in some of these areas.

Bridge Program Students, who have earned a Bachelor of Science in Engineering Technology (B.S.E.T.) degree, or who lack an appropriate background, must take the following courses, in addition to the degree requirements, to make up deficiencies. They must obtain a grade of B or better in each course. At the discretion of the department, students who have taken courses equivalent to these may have their bridge program requirements reduced accordingly.

ECE 232-Circuits and Systems II
ECE 321-Random Signals and Noise
ECE 333-Circuits and Systems III
ECE 361-Electromagnetic Fields I
ECE 362-Electromagnetic Fields II
ECE 372-Electronic Circuits II
ECE 373-Electronic Circuits III

Registration of Bridge Courses:
Students interested in registering for some bridge courses may find it difficult to register online as prerequisite requirements of these courses are not met. In that case, they can contact the concerned department for a permit. ECE Department students can contact Ms. Jacinta Williams at jvw@njit.edu with their ID number.

2. Degree Requirements

Upon entering the program, students select an area of specialization supervised by an area coordinator. The master’s program consists of 30 credits. Students should consult with the area coordinator or designee for their area of specialization before registering for courses to make sure they are meeting department requirements. Area coordinators or their designees must approve any additional courses that students wish to be counted towards their degrees. As a requirement for graduation, students must achieve a 3.0 cumulative GPA overall and in graduate-level courses not including the master’s thesis or project.


Students who enter the electrical engineering master’s program and who receive departmental or research-based awards must complete a master’s thesis.

It is recommended that all master’s students should register for two semesters of ECE 791 Graduate Seminar. However, it is not mandatory. Once registered, in order to receive passing credit, the student must attend at least five (5) seminars per semester, to be chosen from those sponsored by the areas, the ECE department, the Institute, or other outside seminars approved by the Seminar Supervisor. Please
watch the bulletin board labeled *ECE 791 Graduate Seminar*, located in the hall leading to the ECE main office, for information on approved seminars.

Students who enter the program but who did not receive departmental or research-based awards, as well as entering part-time students, have three program options: 24 course credits and 6 credits of ECE 701 Master’s Thesis or 27 course credits and 3 credits of ECE 700 Master’s Project or 30 course credits not to include ECE 700 Master’s Project or ECE 701 Master’s Thesis.

4. Areas of Specialization

Entering full-time students must select an area of specialization during their first semester. Entering part-time students must select an area of specialization by the beginning of their second semester. Further students should contact the MSEE Graduate Advisor for guidance.

Research Area Members

**Communications, Signal Processing and Microwaves**

Dr. Ali Abdi  
Dr. Ali Akansu  
Dr. Nirwan Ansari  
Dr. Yeheskel Bar-Ness  
Dr. Hongya Ge  
Dr. Haim Grebel  
Dr. Richard Haddad  
Dr. Alexander Haimovich  
Dr. Edip Niver  
Dr. Yun-Qing Shi  
Dr. Osvaldo Simeone  
Dr. Gerald Whitman

**Computer Architecture and Systems**

Dr. John Carpinelli  
Dr. Edwin Sui-Hoi Hou  
Dr. Durgamadhab Misra  
Dr. Roberto Rojas-Cessa  
Dr. Jacob Savir  
Dr. Sotirios Ziavras

**Computer Networking**

Dr. Ali Akansu  
Dr. Nirwan Ansari  
Dr. Edwin Sui-Hoi Hou  
Dr. Roberto Rojas-Cessa  
Dr. MengChu Zhou
Electronic and Photonic Devices

Dr. Haim Grebel  
Dr. Durgamadhab Misra  
Dr. Kenneth Sohn  
Dr. Marek Sosnowski  
Dr. Leonid Tsybeskov

Intelligent Systems

Dr. Atam Dhawan  
Dr. Bernard Friedland  
Dr. Walid Hubbi  
Dr. Yun-Qing Shi  
Dr. MengChu Zhou

5. Program Core Requirements
Students are required to take the following core courses:

- ECE 601-Linear Systems (all areas of specialization except Computer Systems)
- Choose at least one out of {ECE 620-Electromagnetic Field Theory or ECE 673-Random Signal Analysis}

6. 500-Level Courses
500-level courses in electrical and computer engineering are not acceptable for credit toward a degree in electrical engineering. Only one 500-level course outside the department may be applied for credit toward a degree in electrical engineering.

7. Area Requirements
A minimum of 24 credits should be from the ECE Department. Students may take up to two courses outside the ECE Department with advisor approval. In addition, it is recommended that every student should register for ECE 791 for two semesters. Note that elective courses are amended periodically, and students can choose electives outside of the lists below with advisor approval.

<table>
<thead>
<tr>
<th>Area Requirements (choose at least two):</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 642-Communication Systems I</td>
</tr>
<tr>
<td>ECE 742-Communication Systems II</td>
</tr>
<tr>
<td>ECE 640-Digital Signal Processing</td>
</tr>
<tr>
<td>ECE 740-Advanced Digital Signal Processing</td>
</tr>
<tr>
<td>ECE 630-Microwave Electronic Systems</td>
</tr>
<tr>
<td>ECE 632-Antenna Theory</td>
</tr>
</tbody>
</table>
**Suggested Electrical Engineering Electives:**
- ECE 609 - Artificial Neural Networks
- ECE 622 - Wave Propagation
- ECE 623 - Fourier Optics
- ECE 625 - Fiber and Integrated Optics
- ECE 626 - Optoelectronics
- ECE 643 - Digital Image Processing I
- ECE 684 - Advanced Microprocessor Systems
- ECE 747 - Signal Decomposition Techniques
- ECE 749 - Compression in Multimedia Engr.
- ECE 755 - Advanced Topics in Digital Communication
- ECE 757 - Wireless Communication
- ECE 776 - Information Theory
- ECE 777 - Statistical Decision Theory in Communications
- ECE 778 - Algebraic Coding for Info. Transmission

**COMPUTER NETWORKING**

**Area Requirements:**
- ECE 683 - Computer Network Design and Analysis
- ECE 783 - Computer Communication Networks

**Suggested Electrical Engineering Electives:**
- ECE 605 - Discrete Event Dynamic Systems
- ECE 637 - Introduction to Internet Engineering
- ECE 638 - Network Management and Security
- ECE 639 - Principles of Broadband ISDN and ATM
- ECE 642 - Communication Systems I
- ECE 644 - Intro. to Wireless & Personal Comm. Systems
- ECE 645 - Wireless Networks
- ECE 658 - VLSI Design
- ECE 677 - Optimization Techniques
- ECE 681 - Broadband Packet Switches
- ECE 690 - Computer Systems Architecture
- ECE 742 - Communications Systems II
- ECE 745 - Advanced Wireless Networks
- ECE 785 - Parallel Processing Systems
- ECE 685 - Network Interface Design
- CIS 610 - Data Structures and Algorithms
- CIS 665 - Algorithmic Graph Theory
- Math 661 - Applied Statistics
- Mgmt 685 - Operations Research and Decision Making
## Computer Architecture and Systems

**Area Requirements:**
- ECE 689-Dig. Sys. Design for Machine Arith.
- ECE 690-Computer Systems Architecture

**Electrical Engineering Electives:**
- ECE 605-Discrete Event Dynamic Systems
- ECE 612-Computer Methods Applied to Power Systems
- ECE 640-Digital Signal Processing
- ECE 643-Digital Image Processing I
- ECE 650-Electronic Circuits
- ECE 660-Control Systems I
- ECE 664-Real-Time Computer Control Systems
- ECE 684-Advanced Microprocessor Systems
- ECE 686-Instrumentation Systems and Microprocessors
- ECE 687-Design of Medical Instrumentation
- ECE 688-Microcontrollers in Instrumentation
- ECE 785-Parallel Process Systems

## Electronic and Photonic Devices

**Area Requirements (choose at least two):**
- ECE 622-Wave Propagation
- ECE 626-Optoelectronics
- ECE 650-Electronic Circuits
- ECE 657-Semiconductor Devices
- ECE 658-VLSI Design I
- ECE 758-VLSI Design II

**Suggested Electrical Engineering Electives:**
- ECE 605-Discrete Event Dynamic Systems
- ECE 623-Fourier Optics
- ECE 624-Optical Engineering
- ECE 625-Fiber and Integrated Optics
- ECE 630-Microwave Electronic Systems
- ECE 660-Control Systems I
- ECE 677-Optimization Techniques
- ECE 684-Advanced Microprocessor Systems
- ECE 690-Computer Systems Architecture
- ECE 730-Theory of Guided Waves
- ECE 739-Laser Systems
- ECE 756-Semiconductor Devices II
- ECE 785-Parallel Processing Systems
- ECE 789-Design for Testability Principle
- ECE 677-Optimization Techniques
- ECE 768-Optimal Control Theory
- Phys 761/787*-Phys. of Sensors & Actuators
- MtSE 702-Characterization of Solids
- MtSE 650-Physical Metallurgy
- MtSE 765-Sci. and Technology of Thin Film

## Intelligent Systems

**Area Requirements (choose at least 2):**
- ECE 605-Discrete Event Dynamic Systems
- ECE 609-Artificial Neural Networks
- ECE 610-Power System Steady-State Analysis
- ECE 660-Control Systems I

**Suggested Electrical Engineering Electives:**
- ECE 611-Transients in Power Systems
- ECE 612-Computer Methods Applied to Power Systems
- ECE 613-Protection of Power Systems
- ECE 614-Dynamics of Electromechanical Energy Conversion
- ECE 615-Advanced Electromechanical Energy Conversion I
- ECE 616-Power Electronics
- ECE 618-Renewable Energy Systems
- ECE 640-Digital Signal Processing
- ECE 664-Real-Time Computer Control Systems
- ECE 666-Control Systems II
- ECE 661-Control System Components
- ECE 677-Optimization Techniques
- ECE 684-Advanced Microprocessor Systems
- ECE 766-Stability Theory of Nonlinear Systems
- ECE 768-Optimal Control Theory
- ECE 769-Stochastic Estimation and Control
- CIS 670-Artificial Intelligence
- CIS 672-Expert System Methods and Design
8. Independent Study
For Master’s students, only one independent study course, ECE 725, will apply towards the MS degree requirement. ECE 726 and ECE 727 will not count towards the Master’s degree course requirement. ECE 725 can be used to satisfy the 9-credit full-time requirement. ECE 726 and ECE 727 cannot be used to satisfy the 9-credit full-time requirement.

9. Master’s Thesis
Before the end of the final term of thesis registration, a Master’s Thesis Committee, consisting of three (3) faculty members, will hear the student present his or her thesis in an open forum (thesis defense). At least two (2) members of the committee must be members of the ECE department. A typed version of the completed thesis should be available to the committee at least three (3) weeks before the oral defense is scheduled and an unbound copy of the thesis should be available in the Department Secretary’s office (235 ECEC) three weeks before the defense. The final version is due in the library to meet graduation requirements by the date specified by the Office of Graduate Studies. Written notice of the presentation will be posted. Interested faculty and graduate students are invited to attend.
V. MASTER OF SCIENCE IN COMPUTER ENGINEERING

Offered by the Department of Electrical and Computer Engineering (ECE)

Graduate Advisor: Dr. MengChu Zhou 347 ECE Center, (973) 596-6282, zhou@njit.edu

1. Admission Requirements
Students are expected to have an undergraduate education in engineering or computer science. Students with baccalaureate degrees in areas other than computer engineering will be required to complete a bridge program. Those with undergraduate degrees in other fields should consult the Director of Computer Engineering for bridge requirements. Bridge courses do not count toward degree requirements.

2. Degree Requirements
Students must complete 30 credits—at least 21 credits that are offered through the Department of Electrical and Computer Engineering—including the two-course sequence in at least one of the four areas of concentration. Students in all areas must take the two required core courses indicated below and complete either a master’s project or thesis. As a requirement for graduation, students must achieve a 3.0 cumulative GPA, not including the master’s thesis or project. The master’s project grade must be B or higher.

Students who enter the computer engineering master’s program and who receive departmental or research-based awards must complete a master’s thesis.

It is recommended that all master’s students should register for two semesters of ECE 791 Graduate Seminar. However, it is not mandatory. Once registered, in order to receive passing credit, the student must attend at least five (5) seminars per semester, to be chosen from those sponsored by the areas, the ECE department, the Institute, or other outside seminars approved by the Seminar Supervisor. Please watch the bulletin board labeled ECE 791 Graduate Seminar, located in the hall leading to the ECE main office, for information on approved seminars.

PLEASE NOTE THAT ECE 684 IS NOT AVAILABLE FOR MSCoE CREDIT.

Registration of Bridge Courses:
Students interested in registering for bridge courses (if any) may find it difficult to register online as prerequisite requirements of these courses are not met. In that case, they can contact the concerned department for a permit. ECE Department students can contact Ms. Jacinta Williams at jvw@njit.edu with their ID number.

3. Core
Required for all specializations are ECE 690-Computer Systems Architecture and CS 610-Data Structures and Algorithms. A project or thesis (3 credits of ECE 700-Master’s Project or 6 credits of ECE 701-Master’s Thesis) is recommended but not mandatory. Note that thesis is required for all those receiving departmental or research-based support.
4. Area Requirements

- **Computer Networking**: For students who want to design and manage both the hardware and software aspects of computer communications and networks. It emphasizes computer network design, security and performance from both the hardware and software perspectives.

- **VLSI System Design**: For students who want to design VLSI circuits or interact with VLSI circuit designers. It emphasizes VLSI design principles and CAD tools for designing and testing VLSI circuits and chips.

- **Intelligent Systems**: For students who want to design and use intelligent systems in application areas such as machine vision systems, computer integrated manufacturing, industrial control and biomedical applications.

- **Computer Architecture and Embedded Systems**: For students who want to design advanced computer systems, including reconfigurable and parallel systems, embedded systems and distributed computing systems. It emphasizes advanced computer architecture and embedded systems design.

**Computer Networking**

*Required:*
ECE 683-Computer Network Design and Analysis
ECE 637-Introduction to Internet Engineering

*Electives (15 to 18 credits):*
ECE 605-Discrete Event Dynamic Systems
ECE 636-Computer Networking Laboratory
ECE 639-Principles of Broadband Networks
ECE 642-Communication Systems I
ECE 673-Random Signal Analysis
ECE 677-Optimization Techniques
ECE 681-Broadband Packet Switches
ECE 685-Network Interface Design
ECE 742-Communication Systems II
ECE 783-Computer Communication Networks
CS 630-Operating System Design
CS 631-Data Management System Design
CS 633-Distributed Systems
CS 637-Real-Time Systems
CS 665-Algorithmic Graph Theory

**VLSI System Design**

*Required:*
ECE 658-VLSI Design I
ECE 758-VLSI Design II

*Electives (15 to 18 credits):*
ECE 605-Discrete Event Dynamic Systems
ECE 683-Computer Network Design and Analysis
ECE 650-Electronic Circuits
ECE 657-Semiconductor Devices
ECE 783-Computer Comm. Networks
ECE 789-Design for Testability Principles
CS 630-Operating System Design
CS 631-Data Management System Design
CS 641-Formal Languages and Automata
CS 665-Algorithmic Graph Theory
IE 605-Engineering Reliability

**Intelligent Systems**

*Required:*
ECE 605-Discrete Event Dynamic Systems
ECE 643-Digital Image Processing I

*Electives (15 to 18 credits):*
ECE 601-Linear Systems
ECE 609-Artificial Neural Networks

**Computer Architecture and Embedded Systems**

*Required:*
ECE 658-VLSI Design I
ECE 692- Embedded Computing Systems

*Electives:*
ECE 605-Discrete Event Dynamic Systems
ECE 609-Artificial Neural Networks
Other courses may be used as electives with the permission of the MS CoE Program Advisor.

5. Master’s Thesis
Before the end of the final term of thesis registration, a master’s thesis committee, consisting of three (3) faculty members, will hear the student who presents his or her thesis in an open forum (thesis defense). At least two (2) members of the committee must be members of the ECE department. A typed version of the completed thesis should be available to the committee at least three (3) weeks before the oral defense is scheduled and an unbound copy of the thesis should be available in the Department Secretary’s office (235 ECEC) three weeks before the defense. The final version is due in the library to meet graduation requirements by the date specified by the Office of Graduate Studies. Written notice of the presentation will be posted. Interested faculty and graduate students are invited to attend.

6. Research Opportunities
Computer engineering faculty research areas include:

- Computer networking
- Multiprocessor system architecture
- Parallel and distributed processing
- Scheduling
- Image processing
- Neural networks and genetic algorithms
- Infrared imaging
- Discrete event system models and tools
- Smart grid
- Big data
- Computer embedded control and intelligent automation
- Robotics
- VLSI design and micro-engineering
- Computer-aided instruction
- Fault-tolerant computing
- Digital testability
- Computer-aided design
- Web service engineering
- Data center modeling and control
- Swarm intelligence
VI. MASTER OF SCIENCE IN TELECOMMUNICATIONS

Offered by the Department of Electrical and Computer Engineering (ECE) and the Department of Computer and Information Science (CIS)

Graduate Advisors:   ECE - Dr. Roberto Rojas-Cessa, (973) 596-3508, rojasces@njit.edu
                    CS - Prof. Dennis Karvelas, (973) 596-2987, e-mail karvelas@njit.edu

1. Admission Requirements
Students can apply for admission to the program through either the Department of Electrical and Computer Engineering or the Department of Computer Science. All applicants must submit scores on the Graduate Record Examinations (GRE) verbal, quantitative, and analytical aptitude tests. Applicants with undergraduate degrees in computer science, computer engineering or electrical engineering from an accredited institution are expected to have a GPA of at least 3.0. It is expected that these students have taken CIS 333, ECE 321 and ECE 333 (or their equivalents). Applicants having degrees in other fields will be considered for admission on an individual basis. These students will be required to complete a bridge program.

Bridge Program - The curriculum for the M.S. in Telecommunications requires a basic knowledge of computer fundamentals such as programming, data structures, computer architecture, signals and systems, and basic communication systems. Bridge courses do not count toward the degree. Completion of the preparatory courses with a 3.0 cumulative GPA or better is required for transfer to matriculated status. The bridge courses are selected from the following list depending on individual background.

ECE 321-Random Signals and Noise*
ECE 333-Circuits and Systems III*
ECE 481-Communications Systems
CS 251/EE 352/CoE 353-Computer Organization/Architecture/Microprocessors
CS 332-Operating Systems
CS 333-UNIX Operating Systems
CS 505-C++ Data Structures

* EE 321 and EE 333 may be substituted with ECE 501, Linear Systems and Random Signals.

2. Degree Requirements
Candidates must complete a minimum of 30 credit hours of course work, with a minimum overall average of 3.0. In addition, a minimum 3.0 GPA is required in the 5 core courses indicated below. Students with an exceptionally strong telecommunications background may be allowed to replace required courses with advanced electives. Permission of the Graduate Advisor from the Department of Electrical and Computer Engineering or the Department of Computer and Information Science is required.

It is recommended that all master’s students should register for two semesters of ECE 791 Graduate Seminar. However, it is not mandatory. Once registered, in order to receive passing credit, the student must attend at least five (5) seminars per semester, to be chosen from those sponsored by the areas, the ECE department, the Institute, or other outside seminars approved by the Seminar Supervisor. Please watch the bulletin board labeled ECE 791 Graduate Seminar, located in the hall leading to the ECE main office, for information on approved seminars.
3. Core Courses (15 credit hours):
ECE 642-Communication Systems I
ECE 644-Introduction to Wireless and Personal Communications Systems
CS 630-Advanced Operating System Design
CS 651-Data Communications
CS 652-Comp. Network-Arch. Protocol Standards or ECE 683 Comp. Network Design & Analysis

4. Elective Courses (15 credit hours):
ECE 638/CIS 696-Networks Management and Security
ECE 639/CIS 697-Principles of Broadband ISDN and ATM
ECE 646-Introduction to Data Communication
ECE 673-Random Signal Analysis I
ECE 685-Network Interface Design
ECE/CIS 700-Project in Telecomm. (3 cr.) or ECE/CIS 701-Thesis in Telecomm. (6 cr.)
ECE 742-Communication Systems II
ECE 755-Digital Communications
ECE 757-Wireless Communications
ECE 783-Computer Communication Networks
ECE 785-Parallel Processing Systems
CS 604-Introduction to Client-Server Computing
CS 631-Data Management System Design I
CS 633-Distributed Systems
CS 637-Real-Time Systems
CS 650-Computer Architecture or ECE 690 Computer Systems Architecture
CS 654-Telecommunication Networks Performance Analysis
CS 656-Internetworking and Higher Layer Protocols
CS 658-Multimedia Systems or ECE 649 Compression in Multimedia Engineering
CS 665-Algorithmic Graph Theory
CS 668-Parallel Algorithms
CS 679-Management of Computer and Information Systems
CS 752-Communication Protocol Synthesis and Analysis
MIS 635-Management of Telecommunications
MIS 636-Telecommunications: Policies and Regulation

5. Areas of Specialization
The following areas of specialization are suggested, but are not the limit of possibilities. They are given to provide a general framework for students.

Management and Administration: ECE 638/CIS 696-Networks Management and Security
MIS 635-Management of Telecommunications
MIS 636-Telecommunications: Policies and Regulation

Communication Systems: ECE 639/CIS 697-Principles of Broadband ISDN and ATM
ECE 646-Introduction to Data Communication
ECE 649-Compression in Multimedia Engineering *or* CIS 658-Multimedia Systems
ECE 673-Random Signal Analysis I
ECE 685-Network Interface Design
ECE 742-Communications Systems II
ECE 755-Digital Communications
ECE 757-Wireless Communications

**Networking:**
ECE 638/CS 696-Networks Management and Security
ECE 639/CS 697-Principles of Broadband ISDN and ATM
ECE 673-Random Signal Analysis
ECE 783-Computer Communication Networks
CS 604-Introduction to Client-Server Computing
CS 633-Distributed Systems
CS 637-Real-Time Systems
CS 650-Computer Architecture *or* ECE 690-Computer Sys. Architecture
CS 654-Telecommunication Networks Performance Analysis
CS 656-Internetworking and Higher Layer Protocols
CS 665-Algorithmic Graph Theory

**Information:**
CIS 604-Introduction to Client-Server Computing
CIS 631-Data Management Systems Design
CIS 658-Multimedia Systems *or* ECE 649-Compression in Multimedia Engineering
CIS 696/ECE 638-Networks Management and Security

Other ECE/CIS courses related to telecommunications may be selected as electives with written approval from the appropriate department Graduate Advisor.
VII. MASTER OF SCIENCE IN POWER AND ENERGY SYSTEMS

Offered by the Department of Electrical and Computer Engineering (ECE)

Graduate Advisor: Dr. MengChu Zhou 347 ECE Center, (973) 596-6282, zhou@njit.edu

1. Admission Requirements
Students can apply for admission to the program through the Department of Electrical and Computer Engineering. Applicants are expected to have excellent undergraduate backgrounds in physics, mathematics (through differential equations and vector analysis), electrical networks and devices, electronics, analysis and design methods, transients, electromagnetic fields, and appropriate laboratory work in some of these areas. All applicants must submit scores on the Graduate Record Examinations (GRE) verbal, quantitative, and analytical aptitude tests. Applicants with undergraduate degrees in electrical engineering, computer engineering or power engineering from an accredited institution are expected to have a GPA of at least 2.8. It is expected that these students have ECE 321 and ECE 333 (or their equivalents). Applicants having degrees in other fields will be considered for admission on an individual basis. These students will be required to complete a bridge program.

Bridge Program - Students who have earned a Bachelor of Science in Engineering Technology (B.S.E.T.) degree, or who lack an appropriate background, must take the following courses, in addition to the degree requirements, to make up deficiencies. They must obtain a grade of B or better in each course. At the discretion of the department, students who have taken courses equivalent to these may have their bridge program requirements reduced accordingly.

ECE 321-Random Signals and Noise
ECE 333-Circuits and Systems III
ECE 361-Electromagnetic Fields I
ECE 362-Electromagnetic Fields II

Registration of Bridge Courses:
Students interested in registering some bridge courses may find it difficult to register online as prerequisite requirements of these courses are not met. In that case, they can contact the concerned department for a permit. ECE Department students can contact Ms. Jacinta Williams at jvw@njit.edu with their ID number.

2. Degree Requirements
Upon entering the program, students select an area of specialization supervised by the MS PES Program Advisor. The master's program consists of 30 credits. Students who enter the program and receive departmental or research-based awards must do 6 credits of master's thesis or 3 credits of master's project as part of the 30 credits requirements. Students should consult with the Program Advisor or designee before registering for courses to make sure they are meeting department requirements. As a requirement for graduation, students must achieve a 3.0 cumulative GPA.

It is recommended that all master’s students should register for two semesters of ECE 791 Graduate Seminar. However, it is not mandatory. Once registered, in order to receive passing credit, the student must attend at least five (5) seminars per semester, to be chosen from those sponsored by the areas, the ECE department, the Institute, or other outside seminars approved by the Seminar Supervisor. Please watch the bulletin board labeled ECE 791 Graduate Seminar, located in the hall leading to the ECE main office, for information on approved seminars.
3. **Core Courses**  6 Credits (2 courses) are required:
   ECE 601  Linear Systems
   ECE 610  Power System Steady-State Analysis

4. **Specialized Courses/Electives: Group A:** Minimum 6 Credits (2 courses) are required from the following:
   ECE 611  Transients in Power Systems
   ECE 616  Power Electronics
   ECE 618  Renewable Energy Systems
   Mgmt 620  Management of Technology

5. **Electives: Group B:** 12 Credits (Non-Thesis), 9 Credits with Project (3 Credits), or 6 Credits with Thesis (6 Credits) are required from the following:
   ECE 605  Discrete Event Dynamic Systems
   ECE 613  Protection of Power Systems
   ECE 617  Economic Control of Interconnected Power Systems
   ECE 637  Introduction to Internet Engineering
   ECE 661  Control System Components
   ECE 683  Computer Network Design and Analysis
   ECE 698  Special Topics: Environmental and Regulatory Issues in Power and Utility Industry
   ECE 698  Special Topics: Recent Advances in Renewable Energy Systems
   ECE 698  Special Topics: Power Generation and Distribution Systems
   ME 607  Advanced Thermodynamics
   ME 610  Applied Heat Transfer
   EnE 671  Environmental Impact Analysis
   IE 614  Safety Engineering Methods
   Mgmt 620  Management of Technology
   Mgmt 691  Legal and Ethical Issues
   Mgmt 692  Strategic Management

   Note: Other electives can be arranged upon the approval of the Advisor of the MS in PES program. Some courses may need proper pre-requisites. Please consult with the instructor and advisor.

6. **Thesis:**
   Before the end of the final term of thesis registration, a master’s thesis committee, consisting of three (3) faculty members, will hear the student who presents his or her thesis in an open forum (thesis defense). At least two (2) members of the committee must be members of the ECE department. A typed version of the completed thesis should be available to the committee at least three (3) weeks before the oral defense is scheduled and an unbound copy of the thesis should be available in the Department Secretary’s office (235 ECEC) three weeks before the defense. The final version is due in the library to meet graduation requirements by the date specified by the Office of Graduate Studies. Written notice of the presentation will be posted. Interested faculty and graduate students are invited to attend.

   ECE 700 Master’s Project (3 credits)
   ECE 701 Master’s Thesis (6 credits)
VIII. DOCTORAL STUDY IN ELECTRICAL AND COMPUTER ENGINEERING

During the first year of doctoral study, students should seek an academic faculty advisor in their area of concentration for advisement on their program of study, including course registration and preparation for the qualifying examination. Students should also speak to area faculty to choose a research advisor and the research topic they will begin after passing the qualifying examination. The academic advisor and the research advisor could be the same person. Students can always visit the Associate Chair for Graduate Studies, to discuss any issues regarding their program.

1. Degree Requirements
Requirements are determined in consultation with department advisors. Students holding a master’s degree will require a minimum of 60 graduate credits beyond the master’s degree. In addition to overall credit requirements, the program includes the following requirements.

- 24 credits of course work beyond the master’s degree (excluding department core courses and other basic area courses)
- at least 12 credits of course work must be at the 700 level
- 500 level, ECE department core courses, ECE 601, ECE 620, ECE 673, and ECE 684, cannot be used to satisfy the 24-credit course requirement.
- In addition, the entry-level courses in the student’s major area cannot be used to satisfy the 24-credit course requirement.

The entry-level courses for each area are as follows:
- Communications and Signal Processing: ECE 640 and ECE 642
- Computer Architecture and Systems: None (only dept. core courses are not allowed);
- Computer Networking: ECE 683;
- Intelligent Systems: ECE 660;

- No more than two independent study courses may be used to satisfy this requirement.
- 36 credits of doctoral dissertation research. With department approval, well-qualified students may register for up to a maximum of 9 credits of ECE 792 Pre-Doctoral Research before completing the qualifying examination. A maximum of 6 credits of ECE 792 may be applied toward ECE 790.
- All doctoral students must register for six semesters of ECE 791 Graduate Seminar. In order to receive passing credit, the student must attend at least five (5) seminars per semester, to be chosen from those sponsored by the areas, the ECE department, the Institute, or other outside seminars approved by the Seminar Supervisor. Please watch the bulletin board labeled ECE 791 Graduate Seminar, located in the hall leading to the ECE main office, for information on approved seminars.
- Students who wish to change majors may do so only once. If students receiving ECE department financial support wish to change majors, their applications for financial aid will be re-evaluated, at the time of switching, as if they were new applicants.

2. Qualifying Examination

Full-time students must take the qualifying exam for the first time within one year of beginning active study and must pass it completely by the next time it is offered. Part-time students must take the qualifying exam for the first time within three years of the beginning of active study and must pass it completely by the next time it is offered. For students admitted into the Ph.D. program at the B.S. level,
the qualifying examination must be taken within one and one half years of admission and must be passed within two years. Students are only permitted to take the examination twice. The passage of the qualifying examinations is reported to the Office of Graduate Studies.

The doctoral qualifying examination currently consists of two portions.

- The **major examination** is taken by the student on a single day and covers predefined subjects in the student’s major area of study.
- The **minor area requirement** is satisfied when the student has received grades of B or better in two predefined courses for the chosen minor area.

(Please, see the Qualifying Examination brochure for more information.)
IX. DOCTOR OF PHILOSOPHY IN ELECTRICAL ENGINEERING

This program is intended for superior students with Master’s or Bachelor’s degrees in electrical engineering, computer engineering, computer science, or other related fields, who wish to pursue advanced research in electrical engineering.

During the first year of doctoral study, students should seek an academic faculty advisor in their area of concentration for advisement on their program of study, including course registration and preparation for the qualifying examination. Students should also speak to area faculty to choose a research advisor and the research topic they will begin after passing the qualifying examination. The academic advisor and the research advisor could be the same person. Students can always visit the Associate Chair for Graduate Studies to discuss any issues regarding their program.

1. Degree Requirements
Requirements are determined in consultation with department advisors. Students holding a master’s degree will require a minimum of 60 graduate credits beyond the master’s degree. In addition to overall credit requirements, the program includes the following requirements.

- 24 credits of course work beyond the master’s degree
- At least 12 credits of course work must be at the 700 level (excluding department core courses and other basic area courses).
- 500 level, ECE department core courses, ECE 601, ECE 620, ECE 673, and ECE 684, cannot be used to satisfy the 24-credit course requirement.
- In addition, the entry-level courses in the student’s major area cannot be used to satisfy the 24-credit course requirement.
  The entry-level courses for each area are as follows:
  - Communications and Signal Processing: ECE 640 and ECE 642
  - Computer Architecture and Systems: ECE 684;
  - Computer Networking: ECE 683;
  - Intelligent Systems: ECE 660;
- No more than two independent study courses may be used to satisfy this requirement.
- 36 credits of doctoral dissertation research. With department approval, well-qualified students may register for up to a maximum of 9 credits of ECE 792 Pre-Doctoral Research before completing the qualifying examination. A maximum of 6 credits of ECE 792 may be applied toward ECE 790.
- All doctoral students must register for six semesters of ECE 791 Graduate Seminar. In order to receive passing credit, the student must attend at least five (5) seminars per semester, to be chosen from those sponsored by the areas, the ECE department, the Institute, or other outside seminars approved by the Seminar Supervisor. Please watch the bulletin board labeled ECE 791 Graduate Seminar, located in the hall leading to the ECE main office, for information on approved seminars.
- Students who wish to change majors may do so only once. If students receiving ECE department financial support wish to change majors, their applications for financial aid will be re-evaluated, at the time of switching, as if they were new applicants.
B.S. to Ph.D. Program

Superior undergraduate students may apply to be admitted directly into the Ph.D. program. Such an accelerated program requires a minimum entrance GPA of 3.5, plus an interview with the ECE department Graduate Studies Committee. Students in this program must complete a total of 87 credits, consisting of 51 course credits and 36 dissertation research credits. At least 12 course credits must be at the 700 level.

2. Qualifying Examination

Full-time students must take the qualifying exam for the first time within one year of beginning active study and must pass it completely by the next time it is offered. Part-time students must take the qualifying exam for the first time within three years of the beginning of active study and must pass it completely by the next time it is offered. For students admitted into the Ph.D. program at the B.S. level, the qualifying examination must be taken within one and one half years of admission and must be passed within two years. Students are only permitted to take the examination twice. The passage of the qualifying examinations is reported to the Office of Graduate Studies.

The doctoral qualifying examination currently consists of two portions.

- The major examination is taken by the student on a single day and covers predefined subjects in the student’s major area of study.
- The minor area requirement is satisfied when the student has received grades of B or better in two predefined courses for the chosen minor area.

(Please, see the Qualifying Examination brochure for more information.)

3. Doctoral Candidacy

Students become doctoral candidates when they pass the qualifying examination. Status as a doctoral candidate does not imply candidacy for the degree. Registration for doctoral research is permitted only to doctoral candidates. Doctoral students who are not yet doctoral candidates may register for pre-doctoral research.

4. Dissertation Committee

A dissertation committee must be formed within twelve months after passing the qualifying examination. The dissertation committee must be approved by the ECE Department Graduate Affairs Committee at the time of its formation and before the presentation of the research proposal. The dissertation committee chairperson typically is the doctoral candidate’s program advisor, but other faculty may be selected, provided that they are from the ECE Department. The committee consists of a minimum of five members, one of whom is external to the ECE Department or to NJIT, and at least three of whom are members of the ECE department. The dissertation advisor must be a tenure-track or tenured faculty member at NJIT. If the dissertation advisor is an ECE department faculty member, then the chair of the student’s dissertation committee may be any tenure-track or tenured faculty member in the ECE Department at NJIT. If the dissertation advisor is not a member of the ECE department at NJIT, then the chair of the student’s dissertation committee must be a tenured faculty member in the ECE department at NJIT. If the dissertation advisor is not an ECE department faculty member, there must be a co-advisor who is a tenure-track or tenured faculty member in the ECE department at NJIT.

5. Research Proposal

Doctoral candidates must prepare a written research proposal for approval by their dissertation committee. The proposal must be presented after formation of the committee but within twelve months after passing
the qualifying exam. The proposal should show that facilities are available to do the work. Research is expected to investigate or develop a unique contribution to science and technology. Research may be experimental, analytical, applied, or theoretical, provided it satisfies these criteria and is approved by the dissertation committee. The research proposal would normally include title and goal of the proposed dissertation; a detailed discussion of background material, including a literature search; a summary of work accomplished to date; a statement of how the residency requirement will be met; and a proposed time table for completion of research.

6. Residency
Doctoral candidates must spend at least one academic year in full-time residence (defined as full-time registration for two consecutive semesters). This requirement is sometimes waived with the approval of the dissertation committee and the Office of Graduate Studies. Such waivers are granted when a candidate’s dissertation research requires use of research facilities at an approved off-campus site.

7. Dissertation and Defense
A dissertation should demonstrate original research that contributes to knowledge in the field. The dissertation should result in scholarly publication and must be defended in a publicly-announced oral defense. A typed version of the completed dissertation should be available to the committee at least three (3) weeks before the oral defense is scheduled and an unbound copy of the thesis should be available in the Department Secretary’s office (235 ECEC) three weeks before the defense. Successful defense of the dissertation is determined by vote of the dissertation committee. All members of the committee must be present to hear the defense. In regard to format, the standard reference is the latest edition of the Estrin/Roche manual Guidelines for Scientific and Professional Theses. The Office of Graduate Studies policies on number of copies, deadlines, and submission of dissertation and abstracts are also to be followed. Every member of the dissertation committee must sign the approval page of the final dissertation document. Students cannot be certified by the ECE department for the doctoral degree until the student submits at least one paper for publication in a peer-reviewed journal deemed of acceptable quality by the dissertation advisor.

8. Grade Point Average
In order to obtain the Doctor of Philosophy degree, candidates must achieve a cumulative grade point average of at least 3.0 in all graduate courses. The 3.0 minimum does not include the grade assigned for completion of the doctoral dissertation. Completion of the dissertation and its defense will be assigned a grade of P for “Passing.” The P grade is for dissertation credits taken in the student’s final semester.

9. ECE Department Financial Support for Doctoral Students
Doctoral students who are receiving financial support (GA or TA) from the ECE department must adhere to the following policies.

At the completion of the first year of support, the student must submit a progress report to the ECE department Doctoral Studies Committee indicating progress in courses, research, and qualifying examinations. In addition, the student’s dissertation advisor must write a request for continued financial support.

Support after the second year is contingent upon satisfying the requirements for qualifying exams, committee formation, and proposal presentation as defined on pages 26 and 27 of this document.

Support for the fourth year, which must be the last year for a TA or GA, will be granted if the student is assured to successfully graduate after this period.
Students who wish to apply for financial aid must be recommended by a faculty member who will submit a letter to the chair of the ECE Graduate Affairs Committee on behalf of the doctoral student. Preference is given to students who have passed the qualifying examination.
X. DOCTOR OF PHILOSOPHY IN COMPUTER ENGINEERING

This program is intended for superior students with master’s or bachelor’s degrees in computer engineering, computer science, electrical engineering, or other related fields, who wish to pursue advanced research in computer engineering.

During the first year of doctoral study, students should seek an academic faculty advisor in their area of concentration to advise on their program of study, including course registration and preparation for the qualifying examination. Students should also speak to area faculty to choose a research advisor and the research topic they will begin after passing the qualifying examination. The academic advisor and the research advisor could be the same person. Students can always visit the Associate Chair for Graduate Studies to discuss any issues regarding their program.

1. Admission Requirements
Applicants are expected to have a master’s degree in computer engineering, computer science, electrical engineering, or other related fields.

Superior undergraduate students may apply to be admitted directly into the Ph.D. program. Such an accelerated program requires a minimum entrance GPA of 3.5, plus an interview with the ECE department Graduate Affairs Committee.

Students must demonstrate superior academic background in engineering, mathematics, and physical science; skills in programming; and proficiency in major areas of computer engineering and science. A minimum master’s GPA of 3.5 on a 4.0 scale, or equivalent, is required for admission. GRE scores must be submitted. Foreign students must also achieve a minimum TOEFL score of 550.

Students who lack an appropriate background will be required to take additional bridge courses that cannot be applied as degree credits.

2. Degree Requirements
Requirements are determined in consultation with department advisors. Students holding a master’s degree will require a minimum of 60 graduate credits beyond the master’s degree. In addition to overall credit requirements, the program includes the following requirements.

- 24 credits of course work beyond the master’s degree
- At least 12 credits of course work must be at the 700 level (excluding department core courses and other basic area courses).
- 500 level, ECE department core courses, ECE 601, ECE 620, ECE 673, and ECE 684, cannot be used to satisfy the 24-credit course requirement.
- In addition, the entry-level courses in the student’s major area cannot be used to satisfy the 24-credit course requirement.

The entry-level courses for each area are as follows:
- Communications and Signal Processing: ECE 640 and ECE 642
- Computer Architecture and Systems: ECE 684;
- Computer Networking: ECE 683;
- Intelligent Systems: ECE 660;
- No more than two independent study courses may be used to satisfy this requirement.
• 36 credits of doctoral dissertation research. With department approval, well-qualified students may register for up to a maximum of 9 credits of ECE 792 Pre-Doctoral Research before completing the qualifying examination. A maximum of 6 credits of ECE 792 may be applied toward ECE 790.

• All doctoral students must register for six semesters of ECE 791 Graduate Seminar. In order to receive passing credit, the student must attend at least five (5) seminars per semester, to be chosen from those sponsored by the areas, the ECE department, the Institute, or other outside seminars approved by the Seminar Supervisor. Please watch the bulletin board labeled ECE 791 Graduate Seminar, located in the hall leading to the ECE main office, for information on approved seminars.

• Students who wish to change majors may do so only once. If students receiving ECE department financial support wish to change majors, their applications for financial aid will be re-evaluated, at the time of switching, as if they were new applicants.

3. Qualifying Examination
Full-time students must take the qualifying exam for the first time within one year of beginning active study and must pass it completely by the next time it is offered. Part-time students must take the qualifying exam for the first time within three years of the beginning of active study and must pass it completely by the next time it is offered. For students admitted into the Ph.D. program at the B.S. level, the qualifying exam must be taken within one and one-half years of admission and must be passed within two years. Students are only permitted to take the examination twice. The passage of the qualifying examinations is reported to the Office of Graduate Studies.

4. Doctoral Candidacy
Students become doctoral candidates when they pass the qualifying examination. Status as a doctoral candidate does not imply candidacy for the degree. Registration for doctoral research is permitted only to doctoral candidates. Doctoral students who are not yet doctoral candidates may register for pre-doctoral research.

5. Dissertation Committee
A dissertation committee must be formed within twelve months after passing the qualifying examination. The dissertation committee must be approved by the ECE department Graduate Affairs Committee at the time of its formation and before the presentation of the research proposal. The dissertation committee chairperson typically is the doctoral candidate’s program advisor, but other faculty may be selected, provided that they are from the ECE department. The committee consists of a minimum of five members, one of whom is external to the ECE department or to NJIT, and at least three of whom are members of the ECE department. The dissertation advisor must be a tenure-track or tenured faculty member at NJIT. If the dissertation advisor is an ECE department faculty member, then the chair of the student’s dissertation committee may be any tenure-track or tenured faculty member in the ECE department at NJIT. If the dissertation advisor is not a member of the ECE department at NJIT, then the chair of the student’s dissertation committee must be a tenured faculty member in the ECE department at NJIT. If the dissertation advisor is not an ECE department faculty member, there must be a co-advisor who is a tenure-track or tenured faculty member in the ECE department at NJIT.

6. Research Proposal
Doctoral candidates must prepare a written research proposal for approval by their dissertation committee. The proposal must be presented after formation of the committee but within twelve months after passing
the qualifying exam. The proposal should show that facilities are available to do the work. Research is expected to investigate or develop a unique contribution to science and technology. Research may be experimental, analytical, applied, or theoretical, provided it satisfies these criteria and is approved by the dissertation committee. The research proposal would normally include title and goal of the proposed dissertation; a detailed discussion of background material, including a literature search; a summary of work accomplished to date; a statement of how the residency requirement will be met; and a proposed time table for completion of research.

7. Residency
Doctoral candidates must spend at least one academic year in full-time residence (defined as full-time registration for two consecutive semesters). This requirement is sometimes waived with the approval of the dissertation committee and the Office of Graduate Studies. Such waivers are granted when a candidate’s dissertation research requires use of research facilities at an approved off-campus site.

8. Dissertation and Defense
A dissertation should demonstrate original research that contributes to knowledge in the field. The dissertation should result in scholarly publication and must be defended in a publicly-announced oral defense. A typed version of the completed dissertation should be available to the committee at least three (3) weeks before the oral defense is scheduled and an unbound copy of the thesis should be available in the Department Secretary’s office (235 ECEC) three weeks before the defense. Successful defense of the dissertation is determined by vote of the dissertation committee. All members of the committee must be present to hear the defense. In regard to format, the standard reference is the latest edition of the Estrin/Roche manual *Guidelines for Scientific and Professional Theses*. The Office of Graduate Studies policies on number of copies, deadlines, and submission of dissertation and abstracts are also to be followed. Every member of the dissertation committee must sign the approval page of the final dissertation document. Students cannot be certified by the ECE department for the doctoral degree until the student submits at least one paper for publication in a peer-reviewed journal deemed of acceptable quality by the dissertation advisor.

9. Grade Point Average
In order to obtain the Doctor of Philosophy degree, candidates must achieve a cumulative grade point average of at least 3.0 in all graduate courses. The 3.0 minimum does not include the grade assigned for completion of the doctoral dissertation. Completion of the dissertation and its defense will be assigned a grade of P for “Passing.” The P grade is for dissertation credits taken in the student’s final semester.

10. ECE Department Financial Support for Doctoral Students
Doctoral students who are receiving financial support (GA or TA) from the ECE department must adhere to the following policies:

At the completion of the first year of support, the student must submit a progress report to the ECE department Graduate Affairs Committee indicating progress in courses, research, and qualifying examinations. In addition, the student’s dissertation advisor must write a request for continued financial support.

Support after the second year is contingent upon satisfying the requirements for qualifying exams, committee formation, and proposal presentation as defined on pages 30 and 31 of this document.
Support for the fourth year, which must be the last year for a TA or GA, will be granted if the student is assured to successfully graduate after this period.

Students who wish to apply for financial aid must be recommended by a faculty member who will submit a letter to the chair of the ECE Graduate Affairs committee on behalf of the doctoral student. Preference is given to students who have passed the qualifying examination.
XI. FACULTY RESEARCH AREAS/INTERESTS

Ali Abdi
(Communications, Signal Processing and Microwaves)
Digital communication and propagation modeling in wireless channels (underwater and RF), channel and parameter estimation techniques, blind modulation recognition, systems biology, molecular networks and cell signaling.

Ali N. Akansu
(Communications, Signal Processing and Microwaves)
Signal and transform theories and applications in financial engineering, next generation internet, wireless OFDM/CDMA communications and RF engineering.

Nirwan Ansari
(Communications, Signal Processing and Microwaves)
Broadband networks, multimedia communications, network security, and computational intelligence.

Yeheskel Bar-Ness
(Communications, Signal Processing and Microwaves)
Design of OFDM, OFDM-MIMO and MC-CDMA, joint design of physical and MAC layers, adaptive processing for MWB, adaptive array and spatial interference cancellation and signal separation for multiuser personal, indoor, and mobile wireless communication (PIMWC), general adaptive signal processing, surface acoustic wave applications, behavior of phase locked and frequency locked loops under interference, the use of chirp transform in analog signal processing and applications for spread spectrum signals.

John Carpinelli
(Computer Architecture and Systems)
Interconnection networks for multiprocessor systems and switching systems, educational computing, distance learning, collaborative filtering.

Atam Dhawan
(Intelligent Systems)
Intelligent medical image analysis, medical imaging, multi-band wavelets, 3-D image reconstruction, neural networks, adaptive learning, genetic algorithms, and pattern recognition.

Bernard Friedland
(Intelligent Systems)
Control theory, especially methods for control of linear and nonlinear systems with data sources of multiple types; applications to friction modeling, compensation, traction control; rapid thermal processing; robotic vehicle navigation and control.

Hongya Ge
(Communications, Signal Processing and Microwaves)
Statistical and array signal processing, reduced-rank subspace methods, detection, estimation, and spectral analysis, adaptive transceiver design for communications, numerical analysis and approximation theory.

Haim Grebel
(Electronic and Photonic Devices)
Nano-technology (e.g. graphene, carbon nanotubes, surface Plasmon lasers, nano-bio), Artificial Dielectrics (AD) for optical and microwave purposes including ultra short pulse antennas (USP antennas, and Infrared (IR) resonating structures for filter and spectral bench-top applications.

Richard A. Haddad
(Communications, Signal Processing and Microwaves)
QMF-wavelet filter realizations, properties, extensions, and implementation of Binomial Hermite filters for parallel processing; adaptive subband signal coding using variable tree structures; time-frequency localization and quantization effects in M-band structures; rank-order filters; special purpose adaptive subband filters;
enhanced DCT algorithms.

**Alex Haimovich**  
(Communications, Signal Processing and Microwaves)  
MIMO and array processing for radar and communications, turbo-coding, space-time coding and ultra-wideband systems.

**Edwin Hou**  
(Computer Architecture And Systems)  
ATM/IP integration, scheduling, genetic algorithms, neural networks, nonlinear optimization techniques, robotics, and infrared imaging.

**Walid Hubbi**  
(Intelligent Systems)  
Power system analysis, power system security, economic operation, distributed generation of electric power and power system operation in a deregulated environment.

**Durgamadhab Misra**  
(Electronic and Photonic Devices)  
Nanoelectronics, High-K gate dielectrics, reliability of CMOS gate oxide, hot carrier effects, interface state reduction through deuterium implantation, Si and SiGe photodetectors, VLSI Design: ASICs, VHDL, Network Architectures, Integrated sensors: chemical sensors and sensor networks, interface circuits, magnetic field sensors.

**Edip Niver**  
(Communications, Signal Processing and Microwaves)  
Wave propagation, antenna and microwave engineering, fiber optic communication systems, applications to biomedical and transportation systems, and numerical methods.

**Roberto Rojas-Cessa**  
(Computer Networking)  
High performance packet switching, fault tolerance and reliability, hardware implementation and VLSI.

**Jacob Savir**  
(Computer Architecture and Systems)  
Test generation, fault simulation, design for testability, computer-aided design, and built-in self-test.

**Yun-Qing Shi**  
(Intelligent Systems)  
Image/video processing and their applications to industrial automation and biomedical engineering, data hiding, image authentication, digital forensics, signal modulation recognition, and medical video compression.

**Kenneth Sohn**  
(Electronic and Photonic Devices)  
Superconductors/superconducting devices, solid-state devices.

**Marek Sosnowski**  
(Electronic and Photonic Devices)  
Materials and structures for micro-electronic and optoelectronic applications, thin film deposition, ion beam modification of materials.

**Leonid Tsybeskov**  
(Electronic and Photonic Devices)  
Group IV semiconductor nanostructures and devices; scanning tunneling microscopy (STM) and STM-based spectroscopy, optical characterization including Raman scattering, photoluminescence and modulation spectroscopy, SiGe nanostructures for light emitters and optical interconnects.
Gerald Whitman  
(Communications, Signal Processing and Microwaves)  
Radiation, propagation and scattering of electromagnetic waves; specific applications include scattering from periodic and random rough surfaces; guidance and radiation from integrated dielectric structures; multiscattering in random media (vegetation) using transport theory; indoor radiowave propagation; transients in dispersive media; ray optics; quasi-optical resonators.

MengChu Zhou  
(Intelligent Systems)  
Computer-integrated manufacturing, intelligent automation, Petri Nets, wireless network, networking security, protocol analysis, discrete event control and simulation and lifecycle engineering design.

Sotirios Ziavras  
(Computer Architecture and Systems)  
Chip multiprocessors, advanced computer architecture, system-on-a-chip design, parallel processing and supercomputing, embedded systems, reconfigurable Computing, VLSI design and FPGA-based system prototyping.
USE OF THIS FORM: to be completed by the student and approved by the Director of Computer Engineering Programs.

NAME OF STUDENT: ____________________________________________________________  
LAST ________________________________________________________________________  
FIRST ________________________________________________________________________  
NJIT I.D. OR SOCIAL SECURITY #: _______________________________________________  

AREA OF CONCENTRATION
- Microprocessor-based systems
- Parallel computing systems
- Computer networking
- VLSI system design
- Machine vision systems

<table>
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<th>Course</th>
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Project/thesis

Area Required Courses

Elective Courses

Required Bridge Courses

Non-degree Courses

STUDENT SIGNATURE: ___________________________  DATE: ____________  
DIRECTOR OF COE PROGRAMS APPROVAL SIGNATURE: ___________________________  DATE: ____________
ECE M.S. THESIS DEFENSE REPORT

USE OF THIS FORM: This form must be completed by the Thesis Committee Chair, approved by the ECE Associate Chair for Graduate Studies immediately after the defense, and submitted to the Office of Graduate Studies.

M.S. PROGRAM: ____________________________________________________________

NAME OF M.S. STUDENT: ____________________________ LAST ______________ FIRST ______________

NJIT I.D. OR SOCIAL SECURITY #: ________________________________________________

FINAL TITLE OF THESIS: _______________________________________________________

____________________________________________________________________________

DATE OF DEFENSE: __________________________________________________________________

NAME, FACULTY RANK, DEPARTMENT/AFFILIATION OF THESIS COMMITTEE CHAIR:

____________________________________________________________________________

NAME, FACULTY RANK, DEPARTMENT/AFFILIATION OF COMMITTEE MEMBERS:

____________________________________________________________________________

RESULTS OF DEFENSE: PASS _____ FAIL _____

CONDITIONS/COMMENTS: ________________________________________________________

SIGNATURE OF THESIS COMMITTEE CHAIR: _______________________________ DATE: __________

SIGNATURE OF ECE ASSOCIATE CHAIR FOR GRADUATE STUDIES: ______________________ DATE: __________

RECEIVED BY OFFICE OF GRADUATE STUDIES: _______________________________ DATE: __________
ECE Ph.D. DISSERTATION COMMITTEE APPOINTMENT REPORT

USE OF THIS FORM: This form is completed upon formation of the Ph.D. dissertation committee. It must be accompanied by a short abstract of the proposed dissertation. The committee must be formed within 12 months after passage of the qualifying examination. The policy for committee formation is described in the latest ECE Handbook for Graduate Students.

Ph.D. PROGRAM:___________________________________________________________

NAME OF DOCTORAL CANDIDATE: ___________________________________________________________________________

NJIT I.D. OR SOCIAL SECURITY #:___________________________________________________________

PRELIMINARY TITLE OF DISSERTATION: _______________________________________________________
_______________________________________________________________________________________

NAME, FACULTY RANK, DEPARTMENT/AFFILIATION OF DISSERTATION COMMITTEE CHAIR:

NAME ______________________________ RANK ______________________________  DEPARTMENT/AFFILIATION ______________________________  SIGNATURE/DATE ______________________________

NAME, FACULTY RANK, DEPARTMENT/AFFILIATION OF COMMITTEE MEMBERS:

NAME ______________________________ RANK ______________________________  DEPARTMENT/AFFILIATION ______________________________  SIGNATURE/DATE ______________________________

DOCTORAL PROGRAMS COORDINATOR APPROVAL SIGNATURE: ______________________________ DATE: ______________

DEPARTMENT CHAIR APPROVAL SIGNATURE: ______________________________ DATE: ______________

RECEIVED BY OFFICE OF GRADUATE STUDIES: ______________________________ DATE: ______________
USE OF THIS FORM: This form must be completed by the Dissertation Advisor immediately after the proposal presentation, and it must be approved by the Doctoral Programs Coordinator before being submitted to the Office of Graduate Studies.

Ph.D. PROGRAM:

NAME OF DOCTORAL CANDIDATE: ____________________________

NJIT I.D. OR SOCIAL SECURITY #: ____________________________

PROPOSED TITLE OF DISSERTATION:

DATE OF PROPOSAL DEFENSE:

DISSERTATION ADVISOR(S):

MEMBERS OF DISSERTATION COMMITTEE AT PROPOSAL DEFENSE:

RESULTS OF DEFENSE: PASS ______  FAIL ______

CONDITIONS/COMMENTS:

DISSERTATION ADVISOR APPROVAL SIGNATURE: ____________________________  DATE: ______

DOCTORAL PROGRAMS COORDINATOR APPROVAL SIGNATURE: ____________________________  DATE: ______

DEPARTMENT CHAIR APPROVAL SIGNATURE: ____________________________  DATE: ______

RECEIVED BY OFFICE OF GRADUATE STUDIES: ____________________________  DATE: ______
ECE Ph.D. DISSERTATION DEFENSE REPORT

USE OF THIS FORM: This form must be completed by either the Dissertation Committee Chair or the Doctoral Programs Coordinator immediately after the defense and submitted to the Office of Graduate Studies.

Ph.D. PROGRAM:______________________________________________________________________________________

NAME OF DOCTORAL CANDIDATE:_______________________________________________________________LASTFIRST

NJIT I.D. OR SOCIAL SECURITY #:______________________________________________________________

FINAL TITLE OF DISSERTATION:___________________________________________________________________
___________________________________________________________________________________________

DATE OF DEFENSE:____________________________________________________________________________

DISSERTATION ADVISOR(S):____________________________________________________________________

___________________________________________________________________________________________

MEMBERS OF DISSERTATION COMMITTEE AT DEFENSE:

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

RESULTS OF DEFENSE: PASS ______ FAIL ______

CONDITIONS/COMMENTS:________________________________________________________________________

DISSERTATION ADVISOR APPROVAL SIGNATURE:____________________________________________DATE:_____

DOCTORAL PROGRAMS COORDINATOR APPROVAL SIGNATURE:________________________DATE:_____

DEPARTMENT CHAIR APPROVAL SIGNATURE:____________________________________________DATE:_____

RECEIVED BY OFFICE OF GRADUATE STUDIES:____________________________________________DATE:_____

46