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COLLEGE OF ENGINEERING

Electrical and Computer
Engineering Department

Handbook for Graduate Students

Department of Electrical and Computer Engineering

College of Engineering

Master of Science in Electrical Engineering

Master of Science in Computer Engineering

**Doctor of Philosophy in Electrical Engineering
(Electrical or Computer Option)**

Robert Peck, Ph.D., Dean

Dayalan Kasilingam, Ph.D., Chairperson

Karen Payton, Ph.D., Graduate Program Director

University
of Massachusetts
Dartmouth

North Dartmouth
Massachusetts
02747-2300 USA

Office of Graduate Studies
College of Engineering
ECE Graduate Program Director

(508)999-8604
(508)999-8539
(508)999-8434

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Foreword

The Department of Electrical and Computer Engineering (ECE) at the University of Massachusetts Dartmouth offers graduate programs leading to the Master of Science in Electrical Engineering (MSEE), the Master of Science in Computer Engineering (MSCPE), and the Doctor of Philosophy (Ph.D.) in Electrical Engineering degrees. It also offers five (5) Graduate Certificate Programs in these areas:

- Communications
- Digital Signal Processing
- Acoustics
- Electrical Engineering Systems
- Computer Systems Engineering

In addition, a Graduate Certificate in **Computer Systems** offered jointly by the Departments of *Computer and Information Science* and *Electrical and Computer Engineering* is available.

This handbook describes the graduate programs in the ECE Department and states various departmental regulations pertaining to the graduate programs. It also describes the procedures to which graduate students must adhere during their studies at the University of Massachusetts Dartmouth. Information provided in this handbook is intended as a supplement to, and not a substitute for, the Graduate School Catalogue of The University of Massachusetts Dartmouth. The Graduate School Catalogue contains general rules and regulations governing the University's graduate programs. The department web site and the Office of Graduate Studies home page are located at <http://www.UMassd.edu/engineering/ece> and <http://www.UMassd.edu/graduate>, respectively.

Introduction

This handbook provides a guide for graduate students who are seeking a Master of Science degree in Electrical Engineering, a Master of Science degree in Computer Engineering, a graduate certificate, or a Doctor of Philosophy degree in Electrical Engineering. The goal of this document is to inform students of the necessary requirements and milestones along the way to their degrees. Appendix B contains the forms needed to satisfy many of these requirements.

This handbook should be used together with the latest copy of the UMass Dartmouth Graduate Catalog, which provides details about program requirements. The Graduate Catalog is available online at <http://www.umassd.edu/catalog/graduate/>. Additional information is also available at the Office of Graduate Studies website: <http://www.UMassd.edu/graduate>.

Other publications to help you understand the policies and requirements at UMass Dartmouth include: the Undergraduate (General) Catalog which is available online at <http://www.umassd.edu/catalog/undergraduate/welcome.cfm> and the Student Handbook (available online at <http://www.umassd.edu/studenthandbook/welcome.cfm>). Additionally, the following offices can assist you: the Office of Equal Opportunity, Diversity and Outreach, the Center for Access and Success, the Cooperative Learning Center, Computer Information Technical Services, and the Registrar's Office.

General Information

Advising and Registration

When you arrive on campus, go to the Electrical and Computer Engineering Department Office (Group II Room 213) where the ECE Graduate Program Director will assign you a temporary advisor. The temporary advisor will be a faculty member who is in your general area of interest, and will provide initial advising for your first semester coursework. Consultation with this temporary advisor concerning your program of study will most likely lead to a discussion with other faculty members, one of whom could become your Graduate Advisor. Selection of a Graduate Advisor is important since he or she will guide your program to completion, will serve as the key member of your graduate committee, and will be the person who advises you on your thesis, project, or dissertation work. Full time students must file a *Selection of a Graduate Advisor* form with the ECE Graduate Program Director before the end of your first semester. Part-time students must file a *Selection of Graduate Advisor* form before completing nine credits. Failure to do so may result in forfeiture of any teaching assistantship (TA) or research assistantship (RA) and inability to register for courses.

All degree candidates must file a *Program of Study* form with the ECE Graduate Program Director. The purpose of the Program of Study is to ensure that you are aware of your degree requirements and that you and your advisor agree on how and when you plan to satisfy them. In

your *Program of Study*, you specify all the courses you plan to take as a graduate student at UMass Dartmouth. This includes formal coursework, independent study, and thesis, project, or dissertation research. *The Program of Study* will also reflect your interests and area of specialization. The *Program of Study* must be approved by your Graduate Advisor before it is filed. All students must file a *Program of Study* by the time they have completed 9 credits. If you do not file an approved *Program of Study* at the appropriate time, you will not be allowed to register for the following semester. The *Program of Study* may be modified due to changes in course offerings or specialization subject to approval of your Graduate Advisor. If any changes are made to your *Program of Study* during your graduate career, you must file a revised program. It is your responsibility, not your Graduate Advisor's, to be sure that the planned program meets all requirements in the Graduate School. If deficiencies are found during certification for graduation, your graduation will be delayed until the deficiencies are removed.

If you choose to do a thesis or project, a Thesis or Project Agreement should be completed before completing 15 credits. Then, you and your advisor can agree on a sequence of courses that will give you the best preparation for your research thesis or project topic as quickly as possible.

Pre-registration periods are specified by the University each semester. Graduate students are strongly encouraged to enroll for the next semester at those times. The ECE Graduate Program Director will not approve ANY assistantships for students who have not already registered for the corresponding semester and filed all appropriate paperwork. The pre-registration period is also a time to review your graduate *Program of Study* and to make whatever changes are appropriate in consultation with your advisor. Pre-registration helps ensure that you will have a place in a course if enrollment is large and that a course you wish to take does not get canceled due to a low enrollment. In addition, if you hold a summer assistantship, you cannot get paid unless you have pre-registered for the fall semester. Fall assistantships will not be renewed if you are not pre-registered, with a *Selection of Advisor* and a *Program of Study* on file with the ECE Graduate Program Director.

Graduate Committees

The current graduate examination committees are MS Thesis, MS Project, PhD Written Comprehensive, PhD Oral Comprehensive and PhD Dissertation. Unanimous approval of the committee is required to pass any examination. For both MS and PhD students, the major advisor chairs the student's committees and must be a full-time faculty member holding their primary appointment in the ECE department. Faculty from other departments may be a co-advisor for an ECE student and should be listed as such on the *Selection of Advisor* form. Each committee is composed of at least three members and a *Selection of Committee* form (see Appendix B) must be filed before a thesis, project or dissertation proposal can be approved. MS Project committees consist of three faculty (including the advisor). MS Thesis committees consist of at least two ECE faculty (including the advisor) and one external member. PhD dissertation committees include three ECE faculty members (including the advisor), one member external to the department, and one external to UMass Dartmouth. In cases where committee members come from outside of the ECE Department the majority of committee members must have their primary appointments in the ECE Department. Committee members from outside the university are permitted subject to

approval of the ECE Graduate Committee and the Graduate Program Director.

Changes in Your Degree Program

After pre-registration, courses may be added or dropped – if needed – with the approval of your Graduate Advisor. At the beginning of each semester, you may officially Add and/or Drop courses without a record on your transcript, during the first week of class. If you withdraw from a course after Add/Drop period through completion of the tenth week of the semester, you will receive a grade of W. After completion of the tenth week, the instructor must assign a letter grade. Grades of W do not affect your GPA. A revised *Program of Study* must be filed to reflect schedule changes.

Course Load Guidelines

A course load of 9 credits per semester is considered minimum for full-time status in the Graduate School at UMass Dartmouth. Students awarded full-time graduate assistantships may take no fewer than 6 and no more than 9 credits (including research, thesis or dissertation) per semester, unless approval is obtained in writing from your advisor, the ECE Graduate Program Director, and the ECE Department Chairperson.

A course load of 7 credits is required for 3/4-time status and of 4 1/2 credits for half-time status. In some cases a student may be deemed to be pursuing full-time studies without being enrolled formally in 9 credits of courses; for example, when a student is enrolled in a project-continuation, thesis-continuation or dissertation-continuation course near the end of the program of study. Contact the Office of Graduate Studies for information about this process.

Satisfactory Academic Progress

Satisfactory progress is indicated by students who

1. maintain a grade point average above 3.0 on a 4.0 scale as computed from their program of study;
2. have received no more than two grades below "B-minus" (2.7 quality points); and
3. are registered for normal course loads or project/thesis/dissertation continuation.

Unsatisfactory academic progress results from failure to meet the above requirements and/or failure to complete program requirements at the appropriate point in the program. Such requirements are: (1) filing an approved *Program of Study* before the completion of nine credits; (2) satisfying the PhD qualifying examination requirements (Ph.D.); (3) filing a *Selection of Committee* form and approved project, thesis or dissertation research proposal; (4) scheduling and passing the comprehensive examination (Ph.D.); (5) scheduling the project, thesis or dissertation defense; and (6) producing final copies of the MS thesis or Ph.D. dissertation. Doctoral students

must complete all requirements for the degree within seven years of being accepted to the program. For students in the MS/Ph.D. track, time in the program begins when they are accepted into the Ph.D. portion of the program. Students who do not maintain satisfactory progress in their degree program risk having assistantship appointments reduced or terminated and/or being dismissed from the program.

Please note that course credits have a longevity of 6 years from the time a course is completed. Only graduate courses in which the student receives a grade of C or better, or 400-level courses in which the student receives a grade of B or better, may be applied towards fulfilling degree requirements. All grades are averaged into the student's record. Required courses in which a student received a grade of C minus or less must be repeated in order for the student to graduate.

Students are in danger of being dismissed if their GPA falls below 3.0 after completion of 15 or more semester hours of coursework, or 50% of the coursework required for the program, whichever is greater. A student who receives three grades below B minus in coursework taken towards the degree will be subject to dismissal. For Ph.D. candidates, failure to satisfy the Qualifying Exam requirements, the Comprehensive Exam, or oral dissertation defense, after a second trial, will be grounds for dismissal. A project, thesis, or dissertation, which is graded F will also be grounds for dismissal. Students will be notified in writing prior to any actions.

In addition to the requirements above, a Ph.D. student must maintain Satisfactory Progress throughout their program. This progress is determined by the unanimous consent of the student's dissertation committee. Beginning with the semester when the student submits a satisfactory dissertation proposal, the student must satisfy one of the following two options to demonstrate satisfactory progress:

1. Hold one dissertation committee meeting in each semester. The meeting should discuss progress since the last committee meeting, and also outline specific plans and goals for the coming semester.

OR

2. Hold one dissertation committee meeting per year and also produce a written progress report detailing the work done during the year and the plans for the coming year.

Every dissertation committee meeting should result in a letter drafted by the advisor describing the progress made and planned work before the next meeting. The letter should contain the sentence "The committee agrees unanimously that the candidate has made satisfactory progress since the last committee meeting." All committee members must sign the letter and a copy should be filed with the ECE Graduate Program Director. In the case of option 2, all committee members must read and approve the progress report, a copy of which should be filed with the ECE Graduate Program Director.

Continuous Registration Requirements

To maintain status as a full-time MS or Ph.D. degree candidate, it is necessary to be enrolled continuously (exclusive of summers) or receive an approved Leave of Absence (see below). If you

continue to work on a thesis, project, or dissertation after completing formal course requirements, you must remain in "Continuation" enrollment status for every semester until the thesis/project/dissertation is completed, including the semester in which final approvals are given. You must register for Thesis/Project/Dissertation Continuation at the Registrar's office and pay a fee in lieu of tuition and regular fees for each semester you are in that status. If you must interrupt progress towards your degree, you need to seek a formal Leave of Absence. Part-time students must register for at least one course per academic year or request a formal Leave of Absence.

In addition, Ph.D. candidates must satisfy the University's residency requirement. All Ph.D. candidates must complete two consecutive semesters as full-time students. Full-time student status is usually defined as taking a minimum of 9 credits of coursework or dissertation per semester. Students with full research or teaching assistantships automatically qualify, independent of their course load.

Interruption or Termination of Studies

Students who must interrupt their studies should apply for a Leave of Absence. A Leave of Absence from graduate studies can be requested with a letter to the ECE Graduate Program Director. The letter should state the reason for the request and the anticipated date for returning. A Leave of Absence involves no fees and does not require a re-admission procedure provided that the student returns by the anticipated date or makes other arrangements. A Leave of Absence differs from Graduate Program Continuation in that the latter involves fees and implies that the student is still participating in the program.

If a student with a Leave of Absence does not return by the date specified, they are considered to have withdrawn from the university. Withdrawal from the University permanently removes the student from the program and is therefore a serious procedure. Any student considering withdrawal should consult with their advisor. If the student subsequently decides to withdraw from the University, she/he should do so formally through the normal University procedure. Withdrawing students who hold University appointments should also submit a letter of resignation to the ECE Graduate Program Director. Full-time students who do not register for any courses or continuing studies, or who do not request a Leave of Absence, will be automatically withdrawn from the University.

Students who have withdrawn from the University and wish to return must apply for re-admission. Application for re-admission is made by written request to the Office of Graduate Studies. Re-admission is granted subject to the approval of the ECE Graduate Program Director, the ECE Graduate Committee, the ECE Department Chairperson, and the Dean of the College of Engineering.

Transfer of Credit

A maximum of 6 semester hours of credit may be transferred from another institution. A maximum of 9 semester hours, which were taken at UMass Dartmouth prior to admission to either

an ECE graduate or certificate program, may be transferred. In total, no more than 9 credits may be transferred unless they are from a certificate program at UMass Dartmouth. All transfer requests (see Transfer of Credit form in Appendix A) must be accompanied by official transcripts (not copies). Supporting information, such as syllabi and detailed course descriptions, that could be useful in the evaluation of transfer credit should be included with the request. Course credits applied in the attainment of another degree from any institution, including UMass Dartmouth, cannot be counted towards the 30 credits needed to obtain the MSEE or MSCPE degree at UMass Dartmouth. Students may submit a Waiver of Requirement (Appendix B) request if they believe they have already taken a course satisfying an ECE degree requirement during the completion of another degree program. Only courses in which a grade of B minus or better was obtained are eligible to be transferred. In all cases, the transfer of course credit must be consistent with a defined *Program of Study*. Applicants to the Ph.D. degree program who have an earned MSEE or MSCPE degree awarded by a recognized institution are usually given appropriate credit.

Degree Certification Deadlines

A student planning to graduate needs to meet several requirements. In terms of scheduling, the most prominent requirement is the oral defense: All degree candidates not in a coursework option must give an oral defense of their thesis, project or dissertation. A student cannot schedule an oral defense until every committee member agrees that the student is ready. This decision is totally up to individual committee members but usually requires a final report/thesis or dissertation that has been through enough revision cycles that it has only minor revision recommendations. After a successful oral defense, additional requirements include having a signed defense signature page, resolving all incomplete grades with change of grade form(s), having advisor and all committee members sign thesis/project report signature page on acid-free paper (not done until all revisions have been made by student), acceptance of the student's thesis or dissertation by the library, returning all keys to department secretary, and completing both ECE Department and UMass Dartmouth exit surveys. In order for students to meet university certification deadlines everyone must abide by the deadlines listed below. If a student does not meet a deadline, he/she will have to meet the next deadline in order to be certified and must register for continuation for the intervening semester. In order to schedule a defense, a student must have the *Oral Defense Request* form (see Appendix B) signed by all committee members before bringing the form to the ECE department office.

Deadlines for Graduate Degree Certifications

Graduation Intent Filing Deadline *	Oral Defense Announcement Deadline **	Oral Defense Completion Deadline	Deadline for Folder to Leave Department ‡	Date on Diploma
July 1	Aug. 1	Aug. 15	Aug. 23	Sept. 1
Nov. 1	Dec. 20	Jan. 15	Jan. 23	Jan. 31
March 15	April 24	Commencement minus 2 weeks	Commencement minus 1 week	Commencement (~May 24)

* All students should notify the Registrar’s Office of their intent to graduate at least two months prior to certification.

** Defenses are not scheduled unless all committee members agree student is ready and must be announced at least 2 weeks before they occur

‡ Thesis and dissertation students are strongly encouraged to schedule their defenses well before the defense deadline so that all necessary approvals can be obtained in time for their folder to leave the department by the corresponding deadline.

Diplomas are mailed from the Registrar’s Office after the Date on Diploma. If degree completion documentation is needed before this date, special arrangements must be made in advance with the Registrar’s Office.

Financing a Graduate Education

The University of Massachusetts Dartmouth has several financial programs to assist with the cost of graduate studies.

A limited number of research and teaching assistantships are available each year. These are awarded based on academic merit and are very competitive. All Teaching Assistantships (TAs) are recommended by the department and college and are awarded through the Office of Academic Affairs [(508)999-8024]. Research Assistantships (RAs) are awarded by a faculty sponsor. If you receive either of these assistantships, contact the ECE Department secretary as soon as you arrive on campus to sign the necessary paperwork to initiate payments. If you receive an RA, contact your faculty sponsor to learn the scope of your assistantship. Renewal of assistantships beyond the initial contract period is determined by the department or the faculty sponsor and the college. Assistantship renewal is contingent upon maintenance of an acceptable grade record and satisfactory progress towards the degree. Performance in the assistantship and availability of funds are also criteria for continuation. MS degree candidates are limited to two years of departmental support.

A full waiver of tuition accompanies all UMass Dartmouth graduate assistantships requiring a minimum commitment of 10 hours work per week. For some assistantships, all or a portion of the CSF fee is waived.

A full-time graduate assistant is expected to work 20 hours per week for the assistantship during the academic year. Full time support in the summer assumes a 40 hours per week commitment.

Some fellowships, scholarships and loans are available from government and private institutions, often for special purposes such as supporting research. The University library reference room has books describing these resources. You can also check with the University's Office of Grants and Contracts.

Appeal Procedure

All appeals of procedure and policies must be made in writing with supporting documentation to the ECE Graduate Program Director. The Director either acts on the appeal or directs it to the Graduate Committee, whichever is most appropriate. All students seeking an appeal must have a faculty advocate, i.e., a faculty member who is willing to support the student's appeal. Normally this will be the student's major advisor. All appeals are to be prepared in consultation with the faculty advocate. Appeals without the support of a faculty advocate will not be considered.

Master of Science Degree

The Master of Science in Electrical Engineering (MSEE) and Master of Science in Computer Engineering (MSCPE) programs at UMass Dartmouth provide sufficient structure to insure that each graduate of the program has a firm academic foundation to go on to further graduate studies or to succeed at the advanced level in industry. However, there is enough program flexibility to allow students to pursue studies of their own particular interest.

There are 3 program tracks to choose from: A Thesis track, a Project track and an All-Coursework track. In the Thesis track, 30 credits must be completed, of which 24 must be at the graduate level and include 6 credits of MS Thesis. Both the Project and All-Coursework tracks also require 30 credits to be completed, of which 24 must be at the graduate level. The Project track requires that 3 of the graduate credits be MS Project, while the All-Coursework track replaces the MS Project with courses appropriate to the student's plan of study. Very rarely a student, with written approval of their advisor, may do a 9-credit thesis or a 6-credit project. Students who select the All-Coursework track must pass a graduate level comprehensive examination or, if they have at least two years work experience as an engineer, they may submit a report documenting work project and/or research experience.

MSEE Requirements:

All students must satisfy four curriculum requirements for the electrical engineering MS degree. These requirements are: 1) core courses, 2) depth courses, 3) breadth courses and 4) capstone experience, i.e., thesis, project, or all course work. The student's advisor and the ECE Graduate Program Director must approve the *Program of Study*.

Core requirement:

All students must take the following **five** core courses:

1. Random Signals and Systems (ECE 521)
2. Mathematics of System Analysis (ECE 581)
3. Computer Systems (ECE 561)
4. A course dealing with wave propagation which may be satisfied with one of the following two courses: Electromagnetics (ECE 540) or Fundamentals of Acoustics (ECE 557)
5. Seminar (ECE 599, 0 credits)

Depth requirement:

Students must satisfy a specialization that includes at least **two** more graduate courses, beyond the requirements above, in one of the specialization areas listed below.

Breadth requirement:

Students must take **one** graduate course outside their main area of study.

Additional course requirement beyond that state above:

One additional course for Thesis track to meet 30 credit requirement.

Two additional courses for Project track to meet 30 credit requirement.

Three additional courses for All-Coursework track to meet 30 credit requirement.

Capstone Experience:

6 credits of MS Graduate Thesis (ECE 600) and Thesis defense for Thesis track

3 credits of MS Graduate Project (ECE 600) and Project defense for Project track

Graduate Level MS Comprehensive Examination or 2 years Industrial/Work Experience for All-Coursework track

Detailed Description of Electrical Engineering Specializations:

1. Applied Acoustics

Underwater/Marine Acoustics, Engineering Acoustics, Acoustics Transduction, Transducers and Arrays, Acoustical Calibration, Sonar Engineering, Bioacoustics, Speech Acoustics, Acoustic Communication.

2. Applied Electromagnetics

Computational Electromagnetics, Antennas, Wireless Communications, Remote Sensing

3. Computers

Database Systems, Computer Architecture, Networking, Neural Networks, Artificial Intelligence

4. Integrated Circuits and Solid State Devices

Solid State Electronics, VLSI, Quantum Electronics

5. Signals and Systems

Digital Signal Processing, Adaptive Signal Processing, Communications, Fuzzy Systems, Estimation Theory, Pattern Recognition, Artificial Intelligence, Speech Processing

6. Applied Optics

Fiber and Integrated Optics, Optical Communication

MSCPE Requirements:

All students must satisfy four curriculum requirements for the computer engineering MS degree. These requirements are: 1) core courses, 2) depth courses, 3) breadth courses and 4) courses required to complete the degree track selected, i.e., Thesis, Project, or All-Coursework. The student's advisor and the ECE Graduate Program Director must approve the *Program of Study*.

Core requirements:

All students must take the following **five** core courses:

1. Computer Operating Systems (ECE 565)
2. Advanced Computer Architecture (ECE 562)
3. Computer Systems Performance Evaluation (ECE 560)
4. Computer Engineering Math (Selected with advisor)
5. Seminar (ECE 599, 0 credits)

Depth requirement:

Students must satisfy a specialization that includes at least **two** more graduate courses, beyond the requirements above, in one of the specialization areas listed below.

Breadth requirement:

Students must take **one** graduate course from a specialization area different than that selected to satisfy the depth requirement.

Additional course requirement:

Students electing the Thesis track must take one additional 400, 500 or 600 level ECE, CIS or MTH course in addition to six credits of MS Graduate Thesis.

Students electing the Project track must take two additional courses. These courses can be from any ECE, CIS or MTH 400, 500 or 600 level offerings, with the stipulation that no more than six credits can be from 400 level courses. This stipulation is further refined for those students electing to take ECE 561 in that no more than three credits may be taken at the 400 level. Additionally, each student must complete three credits of MS Graduate Project.

Students electing the All-Coursework track must take three additional courses, with the additional stipulations regarding 400 level courses and ECE561 stated above for the Project track applying here also.

Detailed Description of Computer Engineering Specializations:

1. Computer Systems Specification, Analysis, Design, Fault Tolerance, and Performance Assessment (Provides the background to do research in the area of computer system design.)
2. Database Systems (Focuses on the architecture and operation of databases, including real-time, fault tolerant, distributed, and secure databases.)
3. Distributed and Parallel Systems (Focuses on the issues present in a distributed and parallel computing environment and on the design and use of such environments.)
4. Microprocessors and Embedded Systems (Considers the various microprocessor technologies, hardware/software tradeoffs and issues related to assemblers and cross compilers.)
5. Networking (Focuses on networking technology and the implementation of network applications.)
6. Operating Systems (Emphasizes the methodologies of operating system design and implementation)
7. Artificial Intelligence, Expert Systems, Neural Networks, and Robotics (Focuses on the development and application of intelligent computer systems.)
8. Reliability Computing (Focuses on models and methods for reliability design and analysis of complex computer-based systems.)
9. Wireless Communications and Networks, Multimedia Communication Systems, Information Security, E-healthcare (Emphasizes on wireless communication protocol design, secure communication systems, multimedia transmission systems and wireless healthcare application design.)

Students are required to satisfy prerequisite requirements for all graduate courses taken.

Detailed Description of All Specializations

Acoustic Transduction focuses on the principles, design and operation of transducers for the reception and generation of underwater sound.

Advanced Automation emphasizes automated and intelligent systems for classification, detection and interpretation with signals and images.

Antennas emphasizes the theoretical and practical issues of radiating systems including linear antennas, phased array antennas, aperture antennas and broadband antennas.

Communication and Information Theory focuses on modern communication theory and systems.

Computer Systems Performance Assessment focuses on the analytic and hardware/software tools to evaluate and compare computer system performance.

Computer Systems Specification, Analysis and Design provides the background to do research in the area of computer system design.

Computer Systems Fault Tolerance focuses on the analytic and hardware/software tools to design and analyze fault-tolerant computer systems.

Computer Systems Reliability Engineering focuses on the analytic techniques and software tools to design and analyze computer-based systems towards high reliability, availability, and safety.

Database Systems focuses on the architecture and operation of databases, including real-time, fault tolerant, distributed, and secure databases.

Digital Signal Processing emphasizes techniques to analyze discrete signals, particularly with computers.

Distributed Systems focuses on the issues present in a distributed computing environment and on the design of such environments.

E-Healthcare Systems focuses on healthcare monitoring system design over wireless networks.

Electro-Optics focuses on modern applications of optical systems, theory and devices.

Fiber Optics emphasizes the properties of optical fibers and devices, including sensors and systems.

Information Security emphasizes on secure communication system design.

Marine Acoustics encompasses the generation, propagation, reception and signal processing of underwater sound.

Marine Electronics focuses on the design and development of electronics for signal conditioning and processing in marine systems.

Marine Mammal Acoustics focuses on the acoustics and signal processing of sounds generated by marine mammals.

Microprocessors considers the various microprocessor technologies, hardware/software tradeoffs and issues related to assemblers and cross compilers.

Microwaves encompasses both theoretical and practical aspects of active and passive microwave circuitry design.

Multimedia Communication focuses on multimedia transmission system design over wireless networks.

Networking focuses on the methodologies of network programming and on the implementation of network applications.

Ocean Optics focuses on the optical properties of ocean water, including molecular optics, scattering, air-sea interactions and inverse problems.

Operating Systems emphasizes the methodologies of operating system design and implementation

Parallel Systems provides the background to do research in parallel processing and parallel computer architectures.

Remote Sensing emphasizes the principles and applications of active and passive remote sensing techniques.

Solid-State Devices provides the background for working in the field of electronic materials and devices.

SONAR and its Applications focuses on the design and application of sonar systems to exploit properties of sound in the ocean environment.

Speech Processing provides the background to do research in the area of speech processing and recognition.

Systems and Control focuses on the mathematical theory underlying the analysis and design of systems, with applications in control systems, optimal control of systems, estimation, and other related topics.

Underwater Propagation focuses on the propagation of sound in the ocean environment.

Underwater Systems emphasizes underwater communications, navigation and instrumentation.

Wireless Communication and networks emphasize on communication architecture and network protocol design.

MSEE and MSCPE Degree Track Descriptions

MSEE and MSCPE Thesis Track

1. A minimum of 30 credits must be completed. These must be in accordance with the *Program of Study* filed by the student and approved by the Graduate Advisor and the Graduate Program Director.
2. At least 24 of the required 30 credits must be at the graduate level (500 series or higher). A grade of C or better is required for all graduate courses to be counted towards the degree.
3. As many as 6 credits of 400 level courses are allowed. In these courses, a grade of B or better is required for them to be counted towards the degree.
4. The program core courses and required depth/breadth courses must be completed as described in the section on course requirements.
5. ECE599 Graduate Seminar (0 Credits) is required for all ECE graduate students. Students need to register in the course once in their graduate study and pass the course requirements. The course is graded on Pass and Fail basis. Students registering in ECE599 must attend at least six seminars publically announced on campus in order to receive a Pass grade. At least three of such seminars are expected to be those organized by ECE Colloquia. Students must inform the instructor ahead of time to attend ECE MS thesis or project presentations, or Ph.D. oral comprehensive or oral defense, or seminars offered by other departments of College of Engineering, and Dept. of Mathematics. Such attendances will be counted toward the six seminar attendance requirement. The instructor keeps updated weekly record of attendance of the course.
6. 6 credits of MS Graduate Thesis (ECE 600) must be completed for the Thesis track. In addition to the written thesis, satisfactory oral presentation and defense of the thesis work is required.
7. No more than 3 credits of independent or directed study (ECE 595, ECE 596) may be applied towards the degree.
8. The thesis must be accepted for library collections. A minimum of 4 copies (2 for the library, 1 for the department, 1 for the Graduate Advisor) and others as requested by Graduate Committee members or other interested parties should be bound.

MSEE and MSCPE Project Track

1. A minimum of 30 credits must be completed. These must be in accordance with the Program of Study filed by the student and approved by the Graduate Advisor and the Graduate Program Director.

- 2 At least 24 of the required 30 credits must be at the graduate level (500 series or higher). A grade of C or better is required for all graduate courses to be counted towards the degree.
- 3 As many as 6 credits of 400 level courses are allowed. In these courses, a grade of B or better is required for them to be counted towards the degree.
- 4 The program core courses and required depth/breadth courses must be completed as described in the section on course requirements.
- 5 ECE599 Graduate Seminar (0 Credits) is required for all ECE graduate students. Students need to register in the course once in their graduate study and pass the course requirements. The course is graded on Pass and Fail basis. Students registering in ECE599 must attend at least six seminars publically announced on campus in order to receive a Pass grade. At least three of such seminars are expected to be those organized by ECE Colloquia. Students must inform the instructor ahead of time to attend ECE MS thesis or project presentations, or Ph.D. oral comprehensive or oral defense, or seminars offered by other departments of College of Engineering, and Dept. of Mathematics. Such attendances will be counted toward the six seminar attendance requirement. The instructor keeps updated weekly record of attendance of the course.
- 6 3 credits of MS Graduate Project (ECE 600) must be completed for the Project track. A written report and satisfactory oral presentation and defense of results are required. A copy of the report should be provided to the department.
- 7 No more than 3 credits of independent or directed study (ECE 595, ECE 596) may be applied towards the degree.

MSEE and MSCPE All-Coursework Track

- 1 Students who are supported by a research assistantship must complete either the Thesis or Project track.
- 2 A minimum of 30 credits must be completed. These must be in accordance with the Program of Study filed by the student and approved by the Graduate Advisor and the Graduate Program Director.
- 3 At least 24 of the required 30 credits must be at the graduate level (500 series or higher). A grade of C or better is required for all graduate courses to be counted towards the degree.
- 4 As many as 6 credits of 400 level courses are allowed. In these courses, a grade of B or better is required for them to be counted towards the degree.
- 5 The program core courses and required specialization/breadth courses must be completed as described in the section on course requirements.

- 6 ECE599 Graduate Seminar (0 Credits) is required for all ECE graduate students. Students need to register in the course once in their graduate study and pass the course requirements. The course is graded on Pass and Fail basis. Students registering in ECE599 must attend at least six seminars publically announced on campus in order to receive a Pass grade. At least three of such seminars are expected to be those organized by ECE Colloquia. Students must inform the instructor ahead of time to attend ECE MS thesis or project presentations, or Ph.D. oral comprehensive or oral defense, or seminars offered by other departments of College of Engineering, and Dept. of Mathematics. Such attendances will be counted toward the six seminar attendance requirement. The instructor keeps updated weekly record of attendance of the course.
- 7 There are two paths for the All Coursework track:
 - a) **Industrial Experience and Project Equivalence:** Students with at least two years of work experience may elect the All-Coursework track when they file their program of study provided they have demonstrated project experience. Documentation regarding work project or research experience must be submitted and approved by the student's advisor. Approval for the All-Coursework track is determined by the ECE Graduate Committee. Guidelines for approval include that the submitted documentation must demonstrate mastery at a level consistent with the content of the program of study. Examples include but are not limited to relevant published journals, conference papers, and company technical reports/memorandums. In the case of multiple authorships, the student's contribution must be clearly identifiable and satisfy the mastery component.
 - b) **MS Comprehensive Examination.** A student may select the All-Coursework track and demonstrate mastery by successfully passing a mastery comprehensive examination. A student that does not pass the comprehensive examination in this All-Coursework track may petition the graduate committee to re-take the examination at its next scheduled offering. A student, who fails the exam once, may request to switch to other tracks with required approval. The maximum number of times a student may sit for the comprehensive exam is two. Students failing the second attempt of the comprehensive exam are dropped from the program.

Milestones to the MSEE or MSCPE Degree

Selection of the Graduate Advisor

Graduate students are assigned a temporary advisor at the start of their graduate study for consultation on matters pertaining to the student's academic program. Based on these consultations, the student's interests, and faculty interests, each student must select their Graduate Advisor by the end of their first semester. Temporary advisors are not expected to advise students beyond the first semester.

Selection of the Graduate Committee

Students in the Thesis track must select 3 faculty to serve as their Thesis Committee before they submit a thesis proposal. The Thesis committee is comprised of a major advisor holding their primary appointment in the ECE department, at least one other ECE faculty member, and one faculty member from outside the department. Students in the Project track must select a Project Committee of at least 3 faculty. The majority of thesis or project committee members must be from the ECE Department. All committee members must sign the student's *Selection of Committee* form (see Appendix B).

The thesis/project committee reviews the student's progress towards the degree. In particular, the committee must unanimously approve the thesis or project. The student's Graduate Advisor, who is chairperson of this committee, must hold their primary appointment in the ECE faculty at UMass Dartmouth. The student is responsible for arranging for faculty to serve on his/her committee. When appropriate, a senior industrial person may serve on the Committee with approval of the ECE Graduate Committee.

Project/Thesis Agreement

This is a preliminary agreement between the student and the Graduate Advisor regarding the general topic to be investigated in the project or thesis. The project/thesis agreement must be filed as soon as the student has decided which track he or she will pursue and what the topic might be. The agreement must be filed no later than the end of the first semester of study (see Appendix B for Agreement form).

Program of Study

All degree candidates must prepare and obtain approval of a *Program of Study* (see Appendix B for the appropriate form). This program is developed in consultation with the student's Graduate Advisor and filed with the ECE Graduate Program Director during the equivalent of the first semester of study (by the time 9 credits have been completed), before registration for the second semester. As the first step in this process, the choice among the Project, Thesis or All-Coursework track must be selected.

Project/Thesis Proposal

Prior to taking ECE 600, a proposal for the project work or thesis research must be prepared by the student in consultation with the Graduate Advisor. The proposal must be approved by the student's Graduate Committee and filed with the ECE Graduate Program Director as a prerequisite to enrolling in thesis or research courses. Students should register for one of the 3 sections offered every semester for ECE 600. Be sure to register for the section with the correct number of credits. All sections are initially listed with the Graduate Program Director as the instructor. After the first month of classes, any student who does not have an approved proposal on file will be dropped from ECE 600. After a review has been made of students registered for ECE 600, sections will be created for each faculty member advising students with approved proposals.

The format for the thesis/project proposal is:

- Cover Page - Title; student name, date, signature of graduate student; names, signatures, date of student's Graduate Committee.
- Background - One paragraph (1/3 page) to orient the reader to the area of research
- Problem Statement - One or two sentences that concisely state the problem that will be addressed by the research.
- Technical Discussion - About one page that presents some of the more important aspects of the proposed research. This should include a summary of the state-of-the-art in the particular research area.
- Approach - One paragraph (1/3 page) that describes the methods that will be applied in conducting the research.
- Bibliography – Full citations of cited literature.
- Schedule and Milestones - Displays a plan for completion of the project or thesis.

Oral Defense

Each degree candidate in the thesis or project track is required to orally present and defend their work to the student's Graduate Committee and invited guests. Students are expected to demonstrate mastery of the material presented and answer any questions the audience poses on the topic. In order to be certified for graduation, the oral defense must be passed at least 16 days prior to the university's degree certification date. All ECE faculty, the College Dean and the Assoc. Provost for Graduate Studies must be notified by public announcement at least 2 weeks in advance of any oral defense. The student's Graduate Committee will determine if the presentation and knowledge demonstrated by the student are sufficient. If not, the student must address whatever concerns the committee has and reschedule the defense.

Project Final Report

The Project Final Report must be turned in to the Graduate Advisor for the student to receive a grade (Pass/Fail) for Graduate Project (ECE 600). While there are no specific format requirements for the Final Report, students are encouraged to be as thorough as possible in describing their work. Advisors are free to impose requirements on the final report.

Thesis Format/Approval

The thesis must be completed in accordance with the rules of the University Graduate School and the College of Engineering. These are outlined in the "UMass Dartmouth Requirements for Theses and Dissertations" available online at http://www.umassd.edu/graduate/currents/thesis_guide_fall_2003.pdf.

Following the oral defense, several signatures are required for final approval of the thesis: the student's Graduate Committee, the ECE Graduate Program Director, the ECE Department Chairperson, the Dean of the College of Engineering, and the Associate Provost for Graduate

Studies. Before copying the document onto acid-free paper, someone in the Graduate Studies Office will read the thesis and provide feedback regarding formatting and other requirements not related to technical content. A minimum of **four** signed thesis copies, on acid-free paper, must be accepted by the library for binding (2 for the library, 1 for the ECE Department and 1 for the Graduate Advisor) before a student can be certified for graduation.

Awarding of the MSEE or MSCPE Degree

When the required program of study has been completed with a cumulative GPA of at least 3.0, and all requirements have been met for approval of the thesis or project, the student is eligible for graduation with the Degree of Master of Science in Electrical Engineering or Master of Science in Computer Engineering. The student may apply for graduation during the final year of his or her program. For students intending to graduate in May, the deadline for notifying the Registrar's Office is March 15. Graduation postings also occur September 1 and February 1. All necessary materials must be approved and signed at least 3 weeks before graduation posting dates.

Requirement Timing Summary - Thesis Track

• Obtain Temporary Advisor	• First semester, before registration
• Select Graduate Advisor	• First semester
• File Graduate Program of Study	• By end of first semester (or 9 credits)
• File Thesis Agreement	• By end of first semester (or 9 credits)
• Select Graduate Committee	• Before Filing Thesis Proposal
• File Thesis Proposal	• Before enrolling in MS Graduate Thesis (ECE 600)
• Apply for Graduation	• At registration for last semester
• Submit Oral Defense Scheduling Request	• Last semester, at least two weeks before oral defense
• Oral Defense	• At least 16 days before close of last semester
• Submit 4 Bound Copies of Approved Thesis	• At least 3 weeks before certification deadline

Requirement Timing Summary - Project Track

• Obtain Temporary Advisor	• First semester, before registration
• Select Graduate Advisor	• First Semester
• File Graduate Program of Study	• By end of first semester (or 9 credits)
• File Graduate Project Agreement	• By end of first semester (or 9 credits)
• Select Graduate Committee	• Before filing Project Proposal
• File Graduate Project Proposal	• Before enrolling in MS Graduate Project (ECE 600)
• Apply for Graduation	• At registration for last semester
• Submit Oral Defense Scheduling Request	• Last semester, at least two weeks before oral presentation
• Oral Defense	• At least 10 days before close of last semester
• Submit Final Approved Project Report	• At least 3 weeks before certification deadline

Requirement Timing Summary - All Coursework Track

• Obtain Temporary Advisor	• First semester, before registration
• Select Graduate Advisor	• First semester
• File Graduate Program of Study	• By end of first semester (or 9 credits)
• Apply for Graduation	• At registration for last semester
• Notify Graduate Program Director of intent to take Comprehensive Examination or submit documentation of 2 years work experience	• By June of last year in program

Doctor of Philosophy Degree in Electrical Engineering

The Doctor of Philosophy Degree (Ph.D.) in Electrical Engineering provides students with the education to be researchers and leaders in their fields of specialization. The program provides both breadth and depth through a flexible structure of formal course work, independent study, and research. The focus of the Ph.D. program is an individualized program of study that prepares the student for Ph.D. dissertation research. Both Electrical (ELE) and Computer (CPE) Engineering Options are available at the Ph.D. level. The dissertation is an original scholarly contribution to the research literature of the field and is the culmination of the student's academic career. ECE faculty members, and their research interests, are listed in Appendix A of this handbook.

The UMass Dartmouth Department of Electrical and Computer Engineering offers two paths leading to the Doctor of Philosophy degree. The first path is the MSEE/Ph.D. or MSCPE/Ph.D. track. Students choosing this track first complete all requirements of the MSEE or MSCPE program and receive an MSEE or MSCPE degree. Students electing this track who do not hold the master's degree are accepted into the MSEE or MSCPE program. Students do not apply for admission to the doctoral program until they have satisfied all MSEE or MSCPE requirements (either at UMass Dartmouth or elsewhere). This path is available to students who already possess an MSEE or MSCPE degree as well as those who possess only a BS degree.

The second path is the direct Ph.D. track that leads to the doctoral degree without obtaining the master's degree. The direct Ph.D. track includes almost all of the master's degree requirements, but as explained later, differs in that there is no research component at the master's degree level. With the approval of their major advisor, students may change from the direct Ph.D. track to the MSEE/Ph.D. or MSCPE/Ph.D. track. A change from the MSEE/Ph.D. or MSCPE/Ph.D. track to the direct Ph.D. track requires approval of the ECE Graduate Committee. This change may affect your graduation date.

It is generally assumed that a student's BS and/or MS degree is in electrical or computer engineering. However, well-qualified applicants with degrees in related fields (e.g., computer science, mathematics, physics, oceanography, or other engineering disciplines) may also apply with the understanding that they may have to address deficiencies in electrical and/or computer engineering before taking the qualifying examination.

The remainder of this section sets forth the general policies and procedures of the Ph.D. program in electrical engineering at the University of Massachusetts Dartmouth. The specific topics addressed are degree requirements, the time line for completing the degree requirements, and the policies and definitions concerning degree requirements.

In all cases, the student is responsible for meeting all degree requirements, including the filing of appropriate forms, the scheduling of examinations and defenses, the preparation of the dissertation, and the payment of all fees.

Doctor of Philosophy Degree Requirements

The requirements for the Ph.D. in Electrical Engineering are summarized below. A more detailed explanation of these requirements, definitions, and policies are given in subsequent sections.

1. Students are required to successfully complete an approved doctoral program of study. Successful completion of the program of study is indicated by a grade point average of 3.0 or better on a 4.0 grading scale with no more than two grades below B-minus. Typically, a minimum of 24 credits beyond the MSEE or MSCPE requirement or 54 credits beyond the BSEE or BSCPE is expected (exclusive of dissertation research). Although it is not necessary to obtain the MSEE or MSCPE degree before proceeding in the Ph.D. program, the MSEE or MSCPE core courses and specialization or thesis requirements must be fulfilled either through the program of study at the University of Massachusetts Dartmouth or through prior graduate studies at another institution.
2. Ph.D. students must satisfy the requirements of either the Electrical Engineering or the Computer Engineering Ph.D. Qualifying Exam. To satisfy the Qualifying Exam requirements, PhD students are required to demonstrate proficiency in the fundamentals of independent research and in the academic fundamentals of their discipline at both the undergraduate and master's levels. PhD students must demonstrate that they meet both the research and academic fundamentals criteria, typically within one year of entering the Ph.D. program.
3. ECE599 Graduate Seminar (0 Credits) is required for all ECE graduate students. Students need to register in the course once in their graduate study and pass the course requirements. The course is graded on Pass and Fail basis. Students registering in ECE599 must attend at least six seminars publically announced on campus in order to receive a Pass grade. At least three of such seminars are expected to be those organized by ECE Colloquia. Students must inform the instructor ahead of time to attend ECE MS thesis or project presentations, or Ph.D. oral comprehensive or oral defense, or seminars offered by other departments of College of Engineering, and Dept. of Mathematics. Such attendances will be counted toward the six seminar attendance requirement. The instructor keeps updated weekly record of attendance of the course.
4. Ph.D. candidates must write a formal Ph.D. dissertation proposal that is satisfactory to all dissertation committee members. The dissertation proposal must provide a thorough survey of the research activities in the research topic area and it must present original and innovative research ideas and preliminary results as well as defined research scope and directions. Ph.D. students must pass ECE 603 Pre-dissertation research (graded Pass/Fail) before registering for dissertation research credits. Passing of ECE 603 is contingent on the acceptance of the student's dissertation proposal by all members of their dissertation committee.

5. Ph.D. candidates must also pass the Ph.D. comprehensive examination. The comprehensive examination verifies that the student is sufficiently prepared to conduct scholarly research in the selected area of the Ph.D. dissertation. Consequently, the Ph.D. comprehensive examination focuses on advanced graduate studies and a formal Ph.D. research proposal.
6. Ph.D. candidates must successfully complete a Ph.D. dissertation. Successful completion of the Ph.D. dissertation is indicated by the satisfactory oral defense of a written dissertation that represents an original contribution to the scholarly research literature of the field. The dissertation normally involves 18 credits of Ph.D. dissertation research (ECE 701).
7. Fulfillment of the research tool (if appropriate) and full-time residency requirements.
8. Payment of all fees, fines, and completion of all other obligations to the University unless specifically waived by the appropriate authority.

Time Line for Completing the Ph.D. in Electrical Engineering

Upon admission to the Ph.D. program, a student is assigned an initial major advisor who is familiar with the student's general research area. After consultation with the initial advisor, another advisor who is more familiar with the candidate's research area and is willing to serve as the major advisor, may be appointed. Before the end of the first year or the completion of twelve credits, and in consultation with the major advisor, the student will have submitted a program of study to the ECE Graduate Program Director. The program of study should conform to the guidelines set forth below (a form has been provided in Appendix A).

A condition for remaining a Ph.D. student is the passing of the Ph.D. qualifying examination. Normally, students in either the MS/Ph.D. or direct Ph.D. tracks satisfy the requirements of the qualifying examination after completing at least 24 course credits, but before the completion of 36 credits. For students entering the program with a Master's Degree in Electrical or Computer Engineering from another university, the examination requirements should be satisfied by the end of their first year in the program. Exceptions to this procedure are made for those students who must address deficiencies in their backgrounds.

Before the completion of all courses, Ph.D. Students must submit the names of the dissertation committee members to the ECE Graduate Program Director (a form has been provided in Appendix A). The dissertation committee should consist, at a minimum, of the student's advisor, two other faculty in the ECE Department, a faculty member from another department at Umass Dartmouth and a faculty member or relevant expert from outside Umass Dartmouth.

The dissertation committee must approve the student's dissertation research proposal. The proposal is prepared by the student in consultation with the committee, and in accordance with the format detailed below. Students working on their proposals after they have completed all their formal coursework and have passed the Ph.D. Qualifying exam requirements, are recommended to register for ECE 603 Pre-Dissertation Research. This course graded Pass/Fail, gives recognition to the effort involved in writing a thorough dissertation proposal and allows students to maintain their

active status in the program between the time they complete their formal coursework and the time they can register for dissertation research. Passing of ECE 603 is contingent on the acceptance of the student's dissertation proposal by all members of their dissertation committee.

Prior to registration for dissertation research (ECE 701), the student will schedule and must pass the Ph.D. comprehensive examination. Upon satisfactory completion of the comprehensive examination, the Ph.D. student status is changed to Ph.D. candidate.

In consultation with the major advisor and committee, the Ph.D. candidate conducts research, prepares the dissertation, and schedules the oral defense of the dissertation. Completion of the research topic requirement is indicated by the satisfactory defense of the dissertation and library acceptance of the final document.

Policies and Definitions for the Ph.D. Program

The following paragraphs set forth both the policies and definitions of the various requirements and related issues of the Ph.D. program.

Major Advisor: The major advisor is a full-time member of the UMass Dartmouth ECE faculty who counsels the student in the preparation of the program of study, directs the selection of the committee, participates in the qualifying examination, mentors the student in research and professional development, and chairs both the comprehensive examination and the oral defense of the dissertation. The selection of an advisor is by the mutual consent of both the student and the faculty member. The relationship may be terminated without prejudice at any time, by either party. In unusual cases, a well-qualified professional who is not a full time UMass Dartmouth ECE faculty member may serve as a co-advisor for dissertation research only, with the approval of the ECE Graduate Committee.

Program of Study: Each student must submit a program of study approved by the major advisor prior to the end of the first year, or the completion of twelve credits. The program of study is filed with the ECE Graduate Program Director. The program serves as a guide for the course work required to support the student's research topic and is the basis on which the student's GPA is computed. The student's program of study defines their Ph.D. degree and should therefore reflect a mature and carefully designed plan for completing the degree requirements. Failure to submit a program of study at the appropriate time is considered an indication of unsatisfactory progress towards the degree and is grounds for dismissal from the program. The program of study may be altered with the approval of the major advisor.

Students are required to successfully complete an approved program of study. Successful completion of the doctoral program of study is indicated by a grade point average of 3.0 or better on a 4.0 grading scale with no more than two grades below B-minus. Typically, a minimum of 24 credits beyond the MSEE or MSCPE requirement or 54 credits beyond the BSEE or BSCPE is expected (exclusive of dissertation research). These requirements represent the equivalent of two years of advanced study beyond the MSEE or MSCPE degree, or three years beyond the BSEE or BSCPE. The expected dissertation research is at least one year of full time work as represented by

a minimum of 18 credits of dissertation research to a maximum of 24 credits. Although it is not necessary to obtain the master's degree before proceeding in the doctoral program, the master's core courses and specialization must be fulfilled either through the program of study at UMass Dartmouth or through prior graduate studies at another institution. Students in the direct Ph.D. track do not, however, have to satisfy the thesis or graduate research requirement at the master's degree level. For students who have completed the master's portion of the MSEE/Ph.D. or MSCPE/Ph.D. track, there are no specific required courses. However, there may be courses that will be required by the student's major advisor. As noted above, the doctoral degree represents a minimum of 72 credits, inclusive of dissertation research, beyond the bachelor's degree. Thus some students' program of study may reflect additional work.

The program of study identifies the general area of research for which the student is preparing and specifically lists all the courses that are to be taken. Both the courses to be taken for credit and those to be taken to address deficiencies (but cannot be counted for credit) are included in the program of study. No credit is allowed for courses below the 400 level, but up to six credits of ECE 400 level courses may be applied to the program. A major advisor may encourage or require a student to take some graduate courses outside of the ECE department in areas that are related to the research topic, such as computer science, mathematics or physics. An additional six credits of courses *from outside the department* may be at the 400 level. Students in the MSEE/Ph.D. or MSCPE/Ph.D. track are allowed up to nine credits of independent or directed study for the Ph.D. portion of their program. For the direct Ph.D. track eighteen credits are allowed. Independent study or directed study courses to be included in the program are to be accompanied by a syllabus, the grading procedure, and the name of the faculty supervisor and must be approved by the Graduate Program Director.

Prior graduate-level courses taken through the UMass Dartmouth ECE graduate program by a matriculated or special student are included as part of the program for the purpose of computing GPA and other requirements. Thus, the Ph.D. program of study is a continuation of a UMass Dartmouth MSEE or MSCPE program of study. Although graduate courses and degrees from other universities are not included in the program in the same way, they are taken into account in establishing the program of study, including the total credit requirement. In all cases, credit longevity may have to be taken into consideration.

If specified by their advisors, a Ph.D. student may be required to have proficiency in a research tool such as computer programming, foreign language(s), statistics, scientific instruments, etc. The appropriate research tool is included in the *Program of Study*.

All Ph.D. students are expected to attend and participate in the graduate seminars and oral presentations as part of their program. Attendance will be taken. An annual one-page report which describes at least two seminars attended must be submitted by the end of each academic year to be placed in the student's file.

Courses taken to make up deficiencies are included in the program of study but are not used in computing the GPA. Deficiencies may be addressed by formal course work, auditing selected classes, self or directed study, or other method approved by the major advisor and the ECE Graduate Program Director. Since the qualifying examination covers both advanced

undergraduate and graduate electrical or computer engineering subjects, it is important that the student's program of study address any serious deficiencies.

Ph.D. Qualifying Examination: ELE/CPE PhD students are required to demonstrate proficiency in the fundamentals of independent research and in the academic fundamentals of their discipline at both the undergraduate and master's levels. PhD students must demonstrate that they meet both the research and academic fundamentals criteria.

Independent Research: The student may satisfy this criterion in one of three ways

- a) Completion of an ELE/CPE Master's Thesis at UMass Dartmouth under the supervision of an ECE faculty and with the recommendation of both the MS and PhD advisor that the student has demonstrated the necessary research potential to be qualified for the PhD program.
- b) Pass an oral exam based on presenting research done for an Master's Thesis at another institution. This oral examination will have the same format as a Master's Thesis defense and the qualifying examination committee will consist of the student's PhD advisor and at least two other potential PhD committee members.
- c) Pass ECE 595: Research Skills: ECE 595: Research Skills is an independent study course. Students will complete a literature search on a topic, replicate the research or conduct new research, present the results in the format of an IEEE conference or journal paper, and defend their findings in an oral exam to a qualifying examination committee consisting of the PhD advisor and potential PhD committee members. The course is graded Pass / Fail.

Academic Fundamentals: The student must satisfy both the graduate and undergraduate portion of this criterion.

Graduate: The student may satisfy this criterion in one of the three following ways

- a) Take the four required MS ELE or CPE core courses at UMassD and obtain a GPA ≥ 3.5
- b) Pass a focused exam on 3 courses in a core specialization of their proposed research area. This exam will consist of six questions, each graded pass/fail. The questions will span advanced undergraduate and introductory graduate topics in the specialization area. The student must receive a passing grade in at least 4 of the 6 questions. The initial anticipated list of specializations based on current research activity in the department are
 - Signal Processing
 - Waves and propagation (electromagnetics, acoustics, optics)
 - Devices and electronics
 - Computer engineering
- c) Pass the Master's Comprehensive Examination administered each August as part of the Coursework MS option.

Undergraduate: The student may satisfy this criterion in one of the three following ways

- a) Hold a BS in ELE/CPE from an ABET accredited institution or equivalent

- b) Petition the graduate committee with the support of a faculty advocate (generally the PhD advisor) to accept equivalent professional experience in electrical or computer engineering as sufficient qualifying background.
- c) Students not possessing an undergraduate degree in ELE/CPE or having deficiencies in their background will complete an individualized program of study for remediation determined by their dissertation advisor and approved by the graduate program director. Courses taken for remediation at the undergraduate level must be completed with a grade of B or better. The schedule for completion will be part of the program of study

Ph.D. Dissertation Committee: The Ph.D. dissertation committee includes the major advisor and no less than four additional committee members. Two of the additional members must be ECE faculty while the other two members must be from outside of the ECE Department with at least one member being from outside of the UMass Dartmouth campus. The major advisor determines the size of the committee. The majority of committee members will be full-time UMass Dartmouth faculty holding their primary appointment in the ECE department. The off-campus member must be approved by the ECE Graduate Committee. Although the committee does not have to be selected until the end of the course work, students are encouraged to do so as early as possible in the program.

The student consults with the committee and apprises them of the research progress at regular intervals as specified in the section on Satisfactory Progress. By consenting to serve on the committee, the members agree to administer the comprehensive examination and the oral defense of the dissertation. Committee members may withdraw from the committee at any time. Any request by the student to change thesis committee members must take the form of a petition submitted to the ECE department graduate committee with approval of the major advisor. The graduate committee will have the final say on any such request. A change of committee structure is a serious matter and should not be undertaken lightly. Depending on the circumstances of the committee change, the graduate committee may require that the student repeat the written or oral comprehensive examination for the new committee. Such a change may impact the student's graduation date.

A change of the graduate advisor is also a serious matter, and should not be undertaken lightly. Such a change requires the approval of the ECE department graduate committee. Such a change will also normally require the student to submit a new thesis proposal, and repeat the written or oral comprehensive examination with the new advisor and committee. This last requirement may be waived under special conditions through a petition to the ECE department graduate committee approved by both the former and new advisors.

Ph.D. Dissertation Proposal: The dissertation proposal is prepared by the student in consultation with the entire dissertation committee. All dissertation committee members must accept the proposal. The dissertation proposal must provide a thorough survey of the research activities in the research topic area and it must present original and innovative research ideas and preliminary results as well as defined research scope and directions. The dissertation proposal should be prepared in accordance with the following format:

Ph.D. Dissertation Proposal Format

1. Cover Page - title; student name, date, signature of graduate student; names, signatures of student's dissertation committee, dates signed.
2. Background Summary - including review of prior research
3. Problem Statement - Including importance of topic and expected contributions to the field.
4. Preliminary Results
5. Proposed Scope and Directions - Including approach or research methodology.
6. Bibliography - Full citations of cited literature
7. Proposed Outline of Dissertation, Schedule for Completion and Milestones - Displays a plan for completion of dissertation.

Students working on their proposals after they have completed all their formal coursework should register for ECE 603 Pre-Dissertation Research. This course, graded Pass/Fail, gives recognition to the effort involved in writing a thorough dissertation proposal and allows students to maintain their active status in the program between the time they complete their formal coursework and the time they can register for dissertation research.

Ph.D. Comprehensive Examination: The comprehensive examination verifies that the student is sufficiently prepared to conduct scholarly research in the selected area of the Ph.D. dissertation. Consequently, the Ph.D. comprehensive examination focuses on advanced graduate studies and a formal Ph.D. research proposal. The minimum prerequisites for scheduling the examination are that the student has a dissertation advisor, a committee has been selected, the courses indicated in the program of study have been (or are about to be) successfully completed, and a research proposal, as defined above, has been unanimously approved by the committee. The examination is conducted in two parts: a written examination followed by an oral examination. The oral examination will be scheduled within four weeks of successful completion of the written examination. The form and content of both parts of the examination are set by the student's committee. The oral examination is nominally two hours. The comprehensive examination is scheduled by the student at the convenience of the committee members, administered by the major advisor, and is composed by the committee members. Successful completion of both the written and oral examination is determined by the unanimous consent of the committee. Students failing to give a satisfactory performance on either part of the examination are allowed a single re-examination of either all, or a portion of either examination as determined by the committee. The reexamination will not take place sooner than six weeks after the student has received the test results. Exceptions to the six-week waiting period are allowed, and an earlier re-examination may be scheduled, but only at the request of the student and with the concurrence of the student's committee.

Dissertation: Ph.D. candidates must successfully complete a Ph.D. dissertation. Successful completion of the Ph.D. dissertation is indicated by satisfactory completion of an approved program of study and the satisfactory oral defense of a written dissertation that represents an original contribution to the scholarly research literature of the field. As such, Ph.D. dissertations are often published in refereed journals or presented at major conferences. The dissertation normally involves 18 credits of Ph.D. dissertation research (ECE 701). The oral defense of the dissertation is scheduled at the request of the student, with the recommendation of the major

advisor and at the convenience of the student's committee. The defense is chaired by the major advisor and is open to the university community. The university community will receive notification of the defense at least fourteen calendar days in advance. Successful defense of the dissertation is determined by the unanimous approval of the dissertation committee. Students who do not successfully defend a dissertation are allowed one additional defense. The second defense is scheduled at the request of the student and at the convenience of the committee. The second defense will not take place sooner than six weeks after first. Exceptions to the six-week waiting periods are allowed, but only at the request of the student and with the concurrence of the student's committee.

Successful completion of the research topic requirement is indicated by the successful defense of the dissertation and library acceptance of two bound copies of the dissertation. The preparation of the final copy of the dissertation must be in conformance with the specifications set forth by the University (see http://www.umassd.edu/graduate/currents/thesis_guide_fall_2003.pdf). A third copy of the dissertation is filed with the ECE Department and a fourth is provided to the student's advisor.

Research Tool: Ph.D. students may be required to have a research tool such as computer programming language, foreign language, statistics, or scientific instrumentation. The research tool is included in the program of study along with the method for evaluating competency. In all cases, the requirement of the research tool is at the discretion of the major advisor.

Residency Requirement: All Ph.D. students must complete two consecutive semesters as full-time students. Full-time student status is usually defined as taking a minimum of 9 credits of course work or dissertation per semester. The residency requirement does not require that students be domiciled at the UMass Dartmouth campus. Students with research or teaching assignments automatically qualify, independent of course load. However, in all cases, fulfillment of the residence requirement is determined by the major advisor.

Intellectual Opportunity Plan: The purpose of the intellectual opportunity plan is to encourage students to venture into new and nontraditional subject areas without putting their scholastic average at risk. Under this plan, a Ph.D. student may include up to six credits (including any for the Master's Degree) of pass/fail course work as part of their program of study. Approval to exercise this track must be obtained from the student's entire committee, the ECE Graduate Program Director and the ECE Department Chairman. A letter grade of C or better is recorded as satisfactory (P) and results in credit being applied to the program of study. A letter grade below C will result in an unsatisfactory (F) and no credit will be applied to the program of study. In either case the grade of P or F does not affect the computation of the GPA but does appear on the student's transcript.

Appendix A: ECE Faculty and Fields of Interest

Aronov, Boris

Adjunct Professor. DSc, Institute of Acoustics, USSR Academy of Science, PhD Electroacoustic Institute, St. Petersburg. *Specializations:* Acoustics, material properties, transduction.

Bilik, Igal

Assistant Professor. PhD, MS, BS Ben-Gurion University of the Negev, Israel. *Specializations:* Adaptive/distributed beamforming, array signal processing, automatic target recognition, detection and estimation theory, radar and sonar systems, signal processing and equalization in multipath channels.

Brown, David A.

Professor. PhD, MS Naval Postgraduate School, BSEE University of Rhode Island. *Specializations:* Acoustic transduction, fiber optic sensors and systems, underwater acoustics, acoustic properties of materials.

Buck, John R.

Professor. PhD Massachusetts Institute of Technology/Woods Hole Oceanographic Institute, SM, SB Massachusetts Institute of Technology. *Specializations:* Underwater acoustics, signal processing, marine mammal bioacoustics.

Chen, Chi Hau

Chancellor Professor. PhD Purdue University, MSEE University of Tennessee, BSEE National Taiwan University. *Specializations:* Pattern recognition, neural networks, image processing and machine vision, communications theory, ultrasonic NDT.

Costa, Antonio H.

Professor. PhD University of Rhode Island, MSEE, BSEE, BS Southeastern Massachusetts University (UMass Dartmouth). *Specializations:* Mixed time-frequency representations, spectral estimation, signal processing, image processing.

Fortier, Paul J.

Professor. DSc UMass Lowell, MSEE Southeastern Massachusetts University (UMass Dartmouth), BSEE UMass Lowell. *Specializations:* Database systems, real-time systems, operating systems, computer architecture, networks, computer performance evaluation.

Geiger, Michael

Assistant Professor. PhD, MSE University of Michigan, BSEE Cornell University. *Specializations:* Computer architecture, memory system design, embedded systems, energy-aware computing.

Helgeland, Robert C.

Professor. MSEE Northeastern University, BSEE Southeastern Massachusetts Technological Institute (UMass Dartmouth); Registered Professional Engineer. *Specializations:* Marine electronic systems.

Kasilingam, Dayalan P. (Chairperson, Department of ECE)

Professor. PhD, MS California Institute of Technology, BA University of Cambridge. *Specializations:* Remote sensing, applied electromagnetics, adaptive signal processing and wireless communications.

Li, Yifei

Assistant Professor. PhD, MS Drexel University, BS Optoelectronics Engineering Huazhong University of Science and Technology, China. *Specializations:* RF/Photonic links, integrated optic devices, microwave, millimeter waves, microchip lasers, and laser dynamics.

Liu, Hong

Professor. PhD Polytechnic University, New York, MS, BS Hefei Polytechnic University, China.
Specializations: Computer networks, compilers, programming languages.

Michel, Howard E.

Associate Professor. PhD Wright State University, MSECE University of Massachusetts Amherst, MS University of Southern California, BS New Jersey Institute of Technology. *Specializations:* distributed artificial intelligence, artificial neural networks, distributed computing, computer vision, computer networks.

Nardone, Steven C.

Professor. PhD, MSEE, BSEE University of Rhode Island. *Specializations:* Systems theory, modern control and estimation theory, signal processing, fuzzy systems.

Payton, Karen L. (Graduate Program Director)

Professor. PhD, MSEE The Johns Hopkins University, BS Electrical & Biomedical Engineering, Carnegie-Mellon University. *Specializations:* Digital signal processing, speech processing, speech acoustics, auditory perception.

Rancour, David

Associate Professor. PhD Purdue University, MSEE Northeastern University, BSEE University of Vermont.
Specializations: Semiconductor defects, solid-state devices and materials.

Streit, Roy

Adjunct Professor. PhD Mathematics University of Rhode Island. *Specializations:* multitarget tracking, multisensor data fusion, distributed autonomous systems, and signal processing

Viall, Philip H.

Professor. MSEE, BSEE Southeastern Massachusetts University (UMass Dartmouth). *Specializations:* Computer networking, assembly languages, rehabilitation engineering.

Wang, Honggang

Assistant Professor, PhD University of Nebraska, MS, BS Southwest Jiaotong University, China.
Specializations: Biomedical computing, embedded systems, multimedia communication, networks and multimedia security, Pattern recognition, sensor networks.

Xing, Liudong

Associate Professor. PhD, MSEE University of Virginia, BE Computer Science Zhengzhou University, China. *Specializations:* Reliability engineering, network reliability, fault-tolerant computing, risk assessment.

Appendix B: Departmental Forms



UMass

Dartmouth

COLLEGE OF ENGINEERING

Electrical and Computer
Engineering Department

GRADUATE PROGRAM OF STUDY MSCPE / MSEE (circle one)

TO: The ECE Graduate Program Director

Student Name: _____ SID: _____

Advisor: _____

Local Address: _____ Telephone: _____

Email Address: _____

Track: THESIS / PROJECT / COURSEWORK* (circle one)

*If choosing the coursework track, include information about your related industrial experience as an attachment.

Year: Semester:	_____	_____	_____	_____
Courses, include project, thesis, independent study and directed study:				

I plan to satisfy the graduate Math requirement with the following course: _____

I plan to satisfy the depth requirement with the following two courses:

I plan to satisfy the breadth requirement with the following course:

Note: Use multiple copies of this form if necessary to include every semester you plan to be registered.

Student Signature: _____

Date: _____

Advisor Signature: _____

Date: _____



UMass

Dartmouth

COLLEGE OF ENGINEERING

Electrical and Computer Engineering Department

Ph.D. GRADUATE PROGRAM OF STUDY

TO: The ECE Graduate Program Director

Student Name: _____ SID: _____

Advisor: _____

Local Address: _____ Telephone: _____

Email address: _____

Option: ELE / CPE (circle one)

Year: Semester:	_____	_____	_____	_____
Courses, include project, thesis, directed / independent study, pre-dissertation and dissertation research:				

Approved courses for transfer credits:

I plan to satisfy the PhD Qualifying Exam requirements as follows:

Undergraduate:

Graduate:

Research:

Note: Use multiple copies of this form if necessary.

Student Signature: _____

Date: _____

Advisor Signature: _____

Date: _____



REQUEST TO SCHEDULE MS/PhD ORAL DEFENSE

We, the undersigned, agree that _____ has completed his/her MS/PhD _____ (thesis/ project report/dissertation) to the extent that we are all comfortable with the student scheduling their Oral Defense. We have all agreed that the following dates & times are acceptable:

Reminder: The defense must be scheduled at least four weeks prior to planned certification date so that the event can be publicized at least two weeks prior to the defense date and that all steps necessary for certification can be completed on time.

The student must take this completed form, with abstract attached, to the ECE Dept. secretary who will schedule the defense at an acceptable time when the ECE Conf. room is available. The student should also email a copy of the abstract to the secretary once the date has been set.

Advisor: _____ Date: _____

Committee member: _____ Date: _____

Committee member: _____ Date: _____

Committee member: _____ Date: _____

Committee member: _____ Date: _____

For Department Use Only:

Scheduled Defense Date: _____ Scheduled Defense Time: _____ Initials: _____



UMass

Dartmouth

COLLEGE OF ENGINEERING

Electrical and Computer
Engineering Department

MS PROJECT/THESIS ORAL DEFENSE

TO: Dean, College of Engineering

FROM: ECE Graduate Program Director

DATE: _____

_____ (Name of student) has successfully completed the oral defense requirement for the MSEE / MSCPE (circle one) on this date.

Advisor: _____

Committee Member: _____

Committee Member: _____

Committee Member: _____



UMass

Dartmouth

COLLEGE OF ENGINEERING

Electrical and Computer
Engineering Department

PhD ORAL DEFENSE

TO: Dean, College of Engineering

FROM: ECE Graduate Program Director

DATE: _____

_____ (Name of student) has successfully completed the oral defense requirement for the PhD in Electrical / Computer (circle one) Engineering on this date.

Advisor: _____

Committee Member: _____

Committee Member: _____

Committee Member: _____

Committee Member: _____

Committee Member: _____



UMass

Dartmouth

COLLEGE OF ENGINEERING

Electrical and Computer
Engineering Department

PETITION FOR WAIVER OF A REQUIREMENT

TO: ECE Graduate Program Director

FROM: (Student Name) _____ SID: _____

Date: _____

Local Address: _____

Telephone: _____ Email: _____

I believe that I have already accomplished the objectives of the following degree requirement:

and that I should therefore have this requirement waived. I understand that a waiver does not reduce the total number of credits required as a graduate student for completion of the M.S. degree.

In the space below give information that justifies your petition (use additional sheets if necessary). Give course numbers, names, where taken and for what degree. Attach a transcript (copy) and circle the applicable courses.

Signed: _____ Date: _____

Approvals:

Advisor: _____ Date: _____

Course Coordinator: _____ Date: _____

ECE Graduate Program Director: _____ Date: _____

Chairperson, ECE Department : _____ Date: _____

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All rules are subject to change at any time in accordance with existing and hereafter adopted University policies.

It is the policy of University of Massachusetts Dartmouth not to discriminate against any applicant for admission or employment, or against any employee, or any educational program, on the basis of race, religion, national origin, age, veteran status, handicap, sex, or sexual orientation. The following person has been designated to handle inquiries regarding the nondiscrimination policies:

*Assistant to the Chancellor for
Equal Opportunity and Affirmative Action
Foster Administration Building, Room 323
University of Massachusetts Dartmouth
285 Old Westport Road
North Dartmouth, MA 02747-2300*

Telephone (508) 999-8017

For information regarding Graduate School admission contact:

*Office of Graduate Studies
University of Massachusetts Dartmouth
285 Old Westport Road
North Dartmouth, MA 02747-2300*

Telephone (508) 999-8604

For information regarding course content or academic advisement contact:

*Program Director
Graduate Programs in Electrical and Computer Engineering
College of Engineering
University of Massachusetts Dartmouth
285 Old Westport Road
North Dartmouth, MA 02747-2300*

*Telephone (508) 999-8434
Email: eegraddir@umassd.edu
Website: www.ece.umassd.edu*

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