

# Rochester Institute of Technology

## Microsystems Engineering PhD Program

### Graduate Student Manual

The purpose of the Graduate Student Manual is to acquaint students with the requirements of the Microsystems PhD program and to help guide them through their course of study. The Manual has been created to capture and clarify the policies and procedures governing graduate study and research in the Microsystems Engineering PhD program. If questions arise, the student can seek clarification from his/her advisor, the Microsystems Engineering Program Office, or the Program Director.

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## Introduction

The Kate Gleason College of Engineering offers a graduate program leading to the Doctor of Philosophy (PhD) degree in Microsystems Engineering. The program builds on the knowledge and skills of traditional engineering and science with concentration in micro- and nano-scale engineering and systems. Graduate students in the program conduct research in a wide variety of areas including nanotechnology, microelectronics, MEMS and NEMS, nanolithography, photonics, microfluidics, nanoelectronics for biomedical systems, micropower devices, and nanomaterials. The faculty are committed to offering students an education that prepares them to be the innovators and leaders in these technology frontiers.

The Graduate Student Manual is intended to provide the student with information about the program and to help guide them through their program of study. Dedicated faculty and staff are always keen to provide additional assistance.

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## The PhD Degree

The Doctor of Philosophy degree in Microsystems Engineering requires concentration and specialization in an associated research area as well as mastery over the fundamentals of Microsystems Engineering. The degree is awarded in recognition of demonstrated proficiency and high achievement in the student's concentration within program. A significant contribution to the knowledge in the area of Microsystems Engineering is made through successful dissertation research and publication. The program curriculum has been designed to meet the individual needs of graduate students while ensuring that all students complete a well-rounded program of study.

# Microsystems Engineering PhD Program Checklist

The following list summarizes key milestones toward a Microsystems Engineering PhD at RIT.

- Admission to the program
- Enroll in the Foundation Courses
- Register to take the Comprehensive Examination (1<sup>st</sup> year)
- Pass the Comprehensive Examination (End of 1<sup>st</sup> year)
- Submit the form for Advisory Committee formation
- Submit a Program of Study Form
- Finish all required coursework
- Research and define dissertation research topic
- Meet with librarian for the College of Engineering (WML)
- Write the Dissertation Proposal
- Register to take the Qualifying Examination
- Pass the Qualifying examination (no later than beginning of third year and at least one year before the Dissertation Defense)
- Continue your research
- Hold periodic reviews of your progress with your Advisory Committee, submit yearly report of progress (end of each Spring quarter)
- Register to take the Candidacy Examination
- Pass the Candidacy Examination (at least six months before the Dissertation defense)
- Write your dissertation
- Register for the Dissertation Defense
- Pass the Dissertation defense
- Certification and graduation

# Microsystems Engineering PhD Degree Requirements

In order for a student to be granted the PhD degree, he/she must satisfy the following minimum requirements:

1. A minimum of 99 total credit hours
  - a. A minimum of 60 of graduate-level coursework quarter credit hours
  - b. A minimum of 27 quarter credit hours of research
2. Pass the Comprehensive Examination (at end of first year)
3. Pass the Qualifying Examination (before the end of third year and at least 12 months before the Dissertation Defense Examination)
4. Pass the Candidacy Examination (at least 6 months before Dissertation Defense Examination)
5. Publish two papers (including at least one referred journal paper) based on his/her dissertation research
6. Pass the Dissertation Defense Examination

## Coursework

The coursework requirements for the PhD degree are divided in four groups to ensure that students complete a well-rounded program of study with the necessary concentration in their specialized field.

### **Group I: Foundation Courses (16 hrs)**

There are four foundation courses that are mandatory:

1. Introduction to Nanotechnology and Microsystems (0308-702)
2. Introduction to Theoretical Methods (1028-704)
3. Microelectronics I (0305-701)
4. Material Science for Microsystems Engineering (0308-703)

### **Group II: Major Technical Interest Area (20 hrs)**

1. A sequence of three courses (12 hrs) in the major technical research area
2. A sequence of two courses (8 hrs) in a support area

### **Group III: Two Minor Technical Interest Areas (16 hrs)**

Two course sequence in each minor technical area. At least one sequence must be outside of the student's undergraduate degree major

### **Group IV: Electives (8 hrs minimum)**

These courses can be prerequisite or remedial courses that are approved by the advisory committee of the student and satisfy the course requirements outlined below

**Research Seminar (no credit)**

The Microsystems Engineering Research Seminar covers various aspects of graduate level research such as methodology and tools of research, using the library, understanding intellectual property and publication rights, collaborating with others, and time management. PhD students should take this class during their first or second quarter in the program.

**Dissertation Research (27 hrs minimum)****Minimum total hours required 99 Hrs**

## General Course Requirements

- The students Program of Study must be approved by the advisor and director.
- The total number of credit hours taken toward the PhD degree depends upon the highest degree completed by the student before entering the program.
- Students entering the program without any prior graduate work must complete a minimum of 60 credit hours of coursework as outlined above.
- The coursework should consist primarily of graduate level (700 and 800) courses with no more than three (3) upper level undergraduate (600) courses.
- All PhD students are required to maintain a cumulative grade point average of 3.0/4.0 to remain in good standing in the program.
- Students entering the PhD program with a Master's degree may be permitted to use up to 32 hours toward the minimum 60 hours of coursework required for the degree, based on the approval of the Program Director.
- MS thesis hours from other schools can only be used when they are recorded on the school's official transcript, and with the approval of the Program Director.

## Examples of Approved Group II, III, and IV courses

Below is a partial listing of the 700 and 800 series graduate courses that can fulfill the coursework requirement for the PhD degree. Students should consult with their advisor to address their specific needs and to tailor their program of study. Some courses also require prior approval of the course instructor. A complete listing of courses can be found in the Graduate Catalog / Bulletin at <http://www.rit.edu/emcs/ptgrad/bulletin.html> .

**Electrical Engineering**

0301-703 Matrix Methods in Electrical Engineering

0301-702 Random Signals and Noise

0301-711 Advanced Carrier Injector Transistors

0301-712 Advanced Field Effect Devices

0301-713 Solid State Physics

0301-717 Microwave Circuit Design

0301-726 Mixed Signal IC Design

0301-729 Antenna Theory and Design  
0301-730 Advanced Analog IC Design  
0301-741 Design for Testability  
0301-761 Modern Control Theory  
0301-789 Fundamentals of MEMS  
0301-798 Microfluidic MEMS  
0301-799 Nano and Microengineering  
0301-804 MEMS Evaluation  
0301-816 Design and Characteristics of Microsystems  
0301-821 High-Performance Semiconductor Devices

### **Industrial Engineering**

0303-766 Manufacturing Systems  
0303-729 Advanced Systems  
0303-758 Design of Experiments  
0303-732 Biomechanics  
0303-886 Systems Engineering

### **Mechanical Engineering**

0304-701 Research Methods  
0304-745 Micro and Nano Characterization of Materials  
0304-746 Engineering Properties of Materials  
0304-752 Fundamentals of Tribology  
0304-811 Theory of Elasticity and Plasticity  
0304-816 Finite Elements  
0304-830 Introduction to Computational Fluid Dynamic Analysis  
0304-831 Computational Fluid Dynamics Applications  
0304-847 Microscale Transport Phenomena  
1028-710 Materials Properties and Selection  
0307-712 Fundamentals of Statistics II  
0307-770 Design of Experiments for Engineers

### **Microelectronic Engineering**

0305-702 Microelectronics II, Lab  
0305-703 Microelectronics III, Lab  
0305-704 Semiconductor Process and Device Modeling  
0305-705 Quantum and Solid State Physics for Nanostructures  
0305-706 SiGe and SOI Devices and Technology  
0305-707 Nanoscale CMOS and Beyond  
0301-712 Physics and Scaling of CMOS  
0305-714 Micro- and Nano-Characterization  
0305-721 Microlithography Materials, Lab  
0305-722 Microlithography Systems, Lab  
0305-731/732\* Microelectronics Manufacturing I/II, Lab

0305-732 Microelectronics Manufacturing II, Lab  
0305-830 Metrology for Yield and Failure Analysis  
0305-870 Microelectromechanical Systems  
0305-890 Special Topics

**Quality and Applied Statistics**

0307-742 Statistical Computing  
0307-717 Design and Analysis of Experiments I  
0307-818 Design and Analysis of Experiments II  
0307-821 Theory of Statistics I  
0307-822 Theory of Statistics II  
0307-824 Probability Models  
0307-830 Multivariate-Analysis Theory  
0307-831 Multivariate-Analysis Applications  
0307-841 Regression Analysis I  
0307-842 Regression Analysis II  
0307-862 Reliability Statistics I

**Microsystems Engineering**

0308-701 Lasers  
0308-712 Non-linear Optics  
0308-711 Microsystem Fundamentals  
0308-731 Integrated Optical Dev/Sys  
0308-751 Microscience Syst/Des  
0308-771 Optoelectronics  
0308-721 Micro-Optics  
0308-786 MEMS Design  
0308-798 MICROFLUIDIC MEMS  
0308-799 Nano- and Microengineering  
0308-804 MEMS Evaluation  
0308-811 Microsystems Design and Packaging  
0308-821 Micro-Optics and Photonics  
0308-831 Micro and Nano-Photonics  
0308-841 Advanced Microphotonics

**Materials Science and Engineering**

1028-701 Introduction to Materials Science  
1028-702 Introduction to Polymer Science  
1028-703 Solid State Science  
1028-704 Introduction to Theoretical Methods  
1028-705 Introduction to Experimental Techniques

**Imaging Science**

1051-716 Fourier Methods for Imaging

1051-719 Radiometry  
1051-724 Introduction to Light, Electron, and Scanning Probe Metrology  
1051-733 Optics  
1051-736 Geometrical Optics and Lens Design  
1051-737 Physical Optics  
1051-738 Optical Image Formation  
1051-739 Principles of Solid State Imaging

#### Chemistry

1008-711 Analytical Chemistry  
1013-737 and 1013-739 Organic Chemistry  
1014-741, 1014-742, 1014-743, and 1014-744 Physical Chemistry  
1012-764 Inorganic Chemistry

## Examples of Course Sequences

Below is a partial listing of course sequences that can fulfill the requirements for the PhD degree. Students should consult with their advisor or the Program Director to address their specific needs and to tailor their program of study.

### **MEMS**

MEMS Design 0308-786

Microsystems Design and Packaging 0308-811

### **Microelectronics**

0305-702 Microelectronics II, Lab

0305-703 Microelectronics III, Lab

0305-707 Nanoscale CMOS and Beyond

### **Nanopatterning**

0305-721 Microlithography Materials, Lab

0305-722 Microlithography Systems, Lab

1051-733 Optics

### **Electronics**

Mixed Signal IC Design 0301-726

Advanced Analog IC Design 0301-730

RF Integrated Circuit Design 0301-814

### **Photonics**

Micro-optics 0308-721

Micro and Nano-Photonics 0308-831

Advanced Micro-photonics 0308-841

### **Microfluidics**

Microscale Heat and Mass Transfer 0304-847

Microfluidic MEMS 0301-798

## Program of Study

Based on the requirements of the Microsystems Engineering PhD program, a student should prepare a Program of Study after passing the Comprehensive Exam and no later than the Winter Quarter of the second year. The form should be signed by the student, the advisor, the director, and the advisory committee. The Program of Study should be reviewed periodically by the student and the advisor and modifications should be made as necessary. Upon completion of the Qualifying and Candidacy exams, the student's advisor and advisory committee may add additional coursework requirements so that the student is sufficiently prepared to carry out and complete his/her dissertation research.

## Applying Coursework from other Schools toward the PhD

The transfer of credits from graduate programs at other schools is based on the approval of the Program Director. The program of study plan serves as an agreement between the student and the Microsystems Engineering Program (on behalf of RIT) to permit the student to use classes from another school toward the PhD requirements.

- Students who have completed Masters degree coursework must list classes taken at RIT and at other schools on their program of study plan.
- Outside classes must be listed as they appear on the other school's transcript, using that school's numbering (if any), course name, and grade awarded.
- The credit hours for classes completed elsewhere should be reported in quarter hours, with semester hours converted to quarter hours where applicable.
- Approval of the PhD Program of Study by the Program Director serves as documentation that the courses will be used toward the PhD coursework requirement.
- PhD students are not permitted to use any pass/fail courses toward course credit hour requirements. This rule applies to courses transferred from other schools.

## Registration for Courses

Students are responsible for course registration each quarter. On-line registration takes place during each preceding quarter (except Fall quarter registration, which opens during the preceding Spring quarter). Entering students typically have the opportunity to register by July or early August of the summer prior to their first year. It is the responsibility of students to make appointments with their advisor (or, for incoming students, the Program Director) at the time of early registration to facilitate course substitutions, elective requests and possible transfer credit requests.

## Credit Limitations

Students may enroll in no more than 18 credit hours per quarter. Overloads require the approval of the Program Director. The Program Director may propose to limit the total number of credit hours a student may take per quarter in the event of continued probationary academic standing. Teaching and research assistants cannot register for more than 16 course credits plus one research credit without prior approval of the Program Director.

## Dissertation Research Credits

A minimum of 27 and a maximum of 39 research credits are required for the PhD degree in Microsystems Engineering. A maximum of 9 research credits may be taken any quarter. No more than 9 research credits should be taken prior to the preparation of the proposal and the taking of the Qualifying Exam. After completing his/her required dissertation credits, a student must remain active by registering for zero to one credit of Continuation of Research. This requirement is waived for all summer quarters. A one quarter extension on time is allowed.

## Schedule Verification and Changes

Following early registration, students will receive a verification of their schedule from the Registrar's Office. The schedule indicated includes all courses for which the student is registered as of the date of issue. A student may change their schedule at any time up to the end of the first six days of the quarter, following the procedure outlined by the RIT Registrar. Students are strongly encouraged to consult with their advisor or the Program Director before adding or dropping classes. Changes in a course schedule through this process are not reflected on a student's quarterly grade report or permanent record.

## Course Withdrawal

If a student wishes to stop participating in a class following the six-day add/drop period, the student must officially withdraw from a course and will receive a grade of W. Students should discuss any withdrawal with the instructor and their advisor. This W grade will be reflected on a grade report and permanent record. Full time students are not permitted to withdraw from classes on-line. Course Withdrawal forms are available from the program office. In addition to the student's signature, the form requires the signature of the faculty member teaching the course and that of the

Program Director. A course withdrawal resulting in a W grade may be obtained through the end of the eighth week of the quarter only. After the eighth week and up to the tenth week, a "W" can only be assigned with the permission of the Director and Dean.

## Schedule of Record

Official notification of a student's final course schedule for a current quarter is issued by the Office of the Registrar approximately three weeks following the first day of class. The student should check this information carefully. Inaccurate information must be reported to the Program Office for a correction to be made. It is the student's responsibility to check the accuracy of this information and to pursue the necessary corrections. Official registration for a course that a student does not attend could result in course overload, F grades, and loss of funding. Lack of registration for a course will result in a student receiving no credit for the course.

## Responsibility

It is the student's responsibility to understand the requirements of the Microsystems Engineering PhD degree program. Progress toward achievement of a degree is maintained by the Microsystems Engineering program office. Access to that information is available to each student upon request to the Program Director. All degree requirements are published yearly in the RIT catalog. Questions regarding changes made in the curriculum during a student's program of study should be directed to the Program Office.

## Time Limitations: the "Seven-Year Rule"

All candidates for the doctoral degree must maintain continuous enrollment during the research phase of the program. Such enrollment is not limited by the maximum number of research credits that apply to the degree. Normally, full-time students complete the course of study for the PhD in an average of four to six years, depending on the degree level upon entering the program, among other things. The seven-year rule requires that all courses used towards the Microsystems Engineering PhD program be completed within seven (7) years of the date the student passes the Comprehensive Exam. The purpose of the rule is to ensure that graduate students have current knowledge in their fields of study when certified by RIT. For example, if the Comprehensive Exam is passed in the fall of the 2008-2009 (quarter 20081), then the student must complete all program requirements by the end of fall 2015-2016 (quarter 20151). Prerequisites courses are excluded from this rule.

If a student does not complete all program requirements within the seven-year time period, course(s) more than seven years old can no longer be counted towards the requirements of the program of study. If this occurs, the student must complete additional course(s) to replace the credit that has expired. If extenuating circumstances prevent a student from completing within the 7-year timeframe, the student may appeal to the Dean of Graduate Studies for permission to complete the degree while retaining the expired course(s). In rare cases, extensions of the seven-year rule may be granted. Petition for an extension is made to the Dean of Graduate Studies, and is initiated via written request to the Program Director.

## Residency

All students in the program must spend at least three consecutive quarters (summer quarter excluded) as resident full-time students to be eligible to receive the doctoral degree. A full-time academic workload is defined as a minimum of nine academic credits per quarter or an equivalent amount of research, as certified by the Program Director.

## Exceptions to Residency Requirement and Time Limitations

If circumstances warrant, the residency requirement may be waived via petition to the Program Director, who will decide on the student's petition in consultation with the advisor and core faculty. The request must be submitted at least nine months prior to the thesis defense. The time limitation may only be waived via petition to the Dean of Graduate Studies, following notification of the Program Director of the intent to petition for such an extension.

## Fellowships

Fellowships in the Microsystems Engineering PhD program are divided into two categories, industrial fellowships and outside fellowships. Additional information regarding graduate student financial aid can be found at <http://www.rit.edu/emcs/ptgrad/financial.html>.

### Industrial Fellowships

The Microsystems Engineering program has strong affiliations with industrial partners, some of which offer fellowship support for students performing research in areas of interest to them while others are open to all qualified students. These fellowships are often tied also to faculty members in these research fields. Some of the Fellowships that have been available to Microsystems Engineering Students are from the following industrial groups. For additional information, students should contact their advisor.

### Outside Fellowships

Fellowships are also available to qualified students and are usually based on national competition. The Microsystems Engineering Program encourages students to apply for these and other Fellowships based on guidance from their advisor.

#### **Department of Energy Computational Science Graduate Fellowship (DOE CSGF)**

This fellowship is for exceptional undergraduate seniors or first or second year graduate students planning full-time study toward a PhD. in the physical, engineering, computer, mathematical, or life sciences. Applicants must be US citizens or permanent resident aliens.

<https://www.krellinst.org/csgf/application>.

#### **Ford Foundation Predoctoral Fellowships for Minorities**

These fellowships are awarded to underrepresented minority students for graduate study.

<http://www7.nationalacademies.org/FORDfellowships/fordpredoc.html>

#### **Fulbright Scholar**

These fellowships were set up to foster closer relations between the United States and other countries. <http://www.iie.org/fulbright>

#### **Hertz Foundation Fellowships**

These fellowships are awarded to outstanding entering graduate students for a five-year-period.

<http://www.hertzfoundation.org>

#### **National Defense Science and Engineering Graduate (NDSEG) Fellowships**

These fellowships are awarded by the government to students who will be doing research in areas of interest to the national defense.

<http://www.asee.org/ndseg>

### **National Science Foundation Fellowships**

These fellowships are given by the National Science Foundation to promising students beginning their graduate career.

[http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=6201](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=6201)

### **NVIDIA Graduate Fellowship**

The Fellowship Program supports candidates conducting advanced research in computer graphics, computer science, computer engineering, electrical engineering, high-performance computing, and computational science and engineering. Candidates should have completed at least one year of their doctoral program at the time of application.

[http://www.nvidia.com/page/fellowship\\_programs.html](http://www.nvidia.com/page/fellowship_programs.html)

### **Semiconductor Research Corporation GRC Fellowship**

The Global Research Collaboration (GRC) graduate fellowship program supports students at the doctoral level that are involved in fields related to the semiconductor industry.

<http://grc.src.org/member/about/aboutgfp.asp>

### **National Defense Science and Engineering Graduate (NDSEG) Fellowships**

As a means of increasing the number of U.S. citizens and nationals trained in science and engineering disciplines of military importance, the Department of Defense (DoD) awards fellowships to individuals who have demonstrated ability and special aptitude for advanced training in science and engineering. <https://ndseg.asee.org/>

## The Comprehensive Examination

Every graduate student interested in pursuing a Microsystems Engineering PhD degree must take the Comprehensive Examination. The Comprehensive Examination tests the student's ability to think and learn independently, to critically evaluate current research work in the field of Microsystems Engineering, and to use good judgment and creativity to determine appropriate directions for future research work. The exam must be completed successfully before a student can submit a thesis proposal and attempt the PhD Qualifying Examination.

- The PhD Comprehensive Exam is given at the end of each Spring Quarter.
- Students intending to take the exam must submit a registration form to the Program Director by the deadline indicated on the form and no later than the first Monday in May.
- Students classified as PhD candidate students at the time of admission must pass the PhD Comprehensive Examination within their first four quarters (not counting summer sessions) in the program.
- If a student fails to complete the exam once registered, it will be considered a failure
- Exemptions for these requirements may be granted to part time students only when prior arrangements are made with the Program Director.
- Students who are unable to take the comprehensive exam for reasons beyond their control should contact the Program Director.

## Goals of the Comprehensive Exam

The goal of the Comprehensive Exam is to a) determine the student's ability to conduct independent research and to b) determine that the student has the proper background to pursue his/her research.

The examination is based upon the student's critical evaluation of current research conducted in a field related to Microsystems Engineering. At the start of the exam process, the graduate faculty of the PhD program will give each student three unique substantive research articles that have been published recently (no more than four years) in peer-reviewed journals. The student is given five days (Monday to Friday) to choose one of these articles as the substance of his/her exam. During the next several weeks, the student reviews the chosen article and all relevant material relating to the article, prepares a written evaluation of the article, and gives an oral presentation to defend his/her point of view on the research and publication. The student must demonstrate an ability to understand the technical aspects of the research, the experimental and/or theoretical approaches used in the investigation, and the significance of the research findings. The student must also discuss any additional work that might be appropriate to strengthen the research described in the article and/or expand upon the work to advance the state of knowledge. In particular, the student is asked to:

1. Identify the questions addressed by the author (i.e., What are the author's hypotheses? What was unknown in the field of study prior to the author's work? What are the key issues that the author is investigating, and why are they important to the field?)

2. Formulate a critical appraisal of the author's contribution to the solution of those questions and the significance of the contribution.
3. Uncover and understand the relevant other work and references related to the research.
4. Propose in concrete terms the research that might be done to extend and (if necessary) improve upon the study discussed in the article.

The student's evaluation of the research article is presented in two parts. First, a written report not exceeding 15 single-spaced pages is prepared and submitted to a faculty committee for evaluation. Then, the student makes an oral presentation (approximately 45 minutes) before the faculty committee to elaborate on and defend the positions taken in the written document. The examining committee will consist of three or more faculty members from among the core and extended faculty of the PhD program. At least one of the members must be a core faculty member of the program.

## Comprehensive Examination Assessment

The results of the Comprehensive Exam are discussed by the examining committee immediately following the completion of the exams and an assessment is made and recorded by the examining committee. The examining committee evaluates the Exam and reports results to the core faculty. The evaluation by the committee will include the following criteria:

1. Quality of the written document (30%)
2. Presentation quality (15%)
3. Presentation delivery (10%)
4. Subject understanding and handling of questions (25%)
5. Whether the student can propose alternative approaches to solve the problem or extend the work presented in the paper (20%)

An evaluation of the student's potential for continuation with the PhD degree is made in a special meeting by the core faculty based on the results reported by the examining committee. The faculty reviews the student's grades, classroom performance, research progress, and performance on the Comprehensive Examination to decide whether to encourage the student to continue in the PhD program, identify a research topic, and prepare for the PhD Oral Qualifying Examination. The core faculty evaluates the overall student's performance and makes their decision to grant one of the following:

1. An unconditional pass
2. A conditional pass with recommended remedial action(s)
3. A failure

The decision is communicated to the student by the advisor or another faculty member assigned by the core faculty.

## PhD Advising

PhD supervision and advising is carried out by the student's advisor, advisory committee, and the program director.

### The Research Advisor

In the first year of their program, a student is expected to identify a research advisor and report that advisor's name to the PhD Program Director. Typically, the student selects a research advisor who also then acts as an academic advisor. Advisors are prepared to assist students with issues regarding curriculum requirements, elective choices, stipend support, presentations and publication, RIT support facilities, and concerns of a more personal nature (such as time management). An advisor selection should be reported before the end of the quarter following the student's successful completion of the Comprehensive Examination. It may be necessary and appropriate for a student to change advisors during the process of identifying a suitable dissertation topic. Any change should be promptly reported to the PhD Program Director.

### PhD Advisory Committee

After passing the Comprehensive Examination, and during the process of formulating a dissertation research proposal, the student together with his/her advisor should also form an advisory Committee. The committee must include a minimum of four people including the advisor and a fifth member assigned by the Program Director (the "external member"). The external member must be a tenured member of the RIT faculty who holds a PhD and is not a core faculty member of the Program. The research committee will help supervise the student's research, including review of the research proposal (typically as part of the PhD Qualifying Exam), meeting with the student during the course of the research, and conducting the dissertation defense.

The specific requirements for the committee are:

- Four or more members (including the advisor)
- Members represent at least two concentration areas
- Members should include faculty from at least two departments
- A committee member from industry or government research lab is beneficial
- The advisor is the chair of the committee
- An external member will be assigned by the PhD Program Director and approved by the Dean of Graduate Studies

## The Research Proposal

A research topic is chosen by the student and his/her research advisor, which will be the basis for the dissertation. The research proposal sets forth both the exact nature of the matter to be investigated and a detailed account of the methods to be employed. In addition, the proposal usually contains material supporting the importance of the topic selected and the appropriateness of the research methods to be employed.

The proposal should not be construed as a “binding contract” between the committee and the student, but as a somewhat flexible agreement that is expected to evolve as the research progresses.

### Proposal Goals

The Qualifying Exam (see below) is carried out to assess the students preparedness to carry out the research as put forth in the research proposal. The proposal (the only written component of the Qualifying Exam) should address the following areas:

Dissertation Subject - What is the proposal subject? What are its limits? This should probably be stated at the beginning of the proposal.

Methodology - What type of question will the dissertation address, and how will it try to answer it?

Significance - Why is the subject important? What light may it shed on larger questions, or in what other way may it contribute to our field. Is the subject of sufficient interest that the dissertation is likely to be publishable?

State of existing scholarship - To what extent has the subject already been studied? What are the strengths or deficiencies of the existing scholarship?

Work Accomplished - How far has the student already progressed into the study?

Work Remaining - What research will be required, and where will it be done? How long is it likely to take? Are there any special problems that may affect the course of the dissertation work?

References – A thorough list of relevant literature references pertaining to the subject.

Timeline - Tentative schedule and plan for the completion of the dissertation.

Additionally, the proposal should answer these questions:

1. What is the problem?
2. Who cares? (an argument about its importance)
3. What have others done? (the literature review)
4. What is your approach? (your general approach, the new idea)
5. What are you going to do explicitly?
6. What will happen? (or did happen, if you have results)
7. What does this mean? (in terms of answering the problem)
8. Who cares? (in what way is this important)

9. Where will you publish these results?

## Proposal Guidelines

The proposal is a substantial document and its importance should not be underestimated. A proposal should demonstrate that you have a thorough insight into the nature of a problem as well as the means to explore it. It should explain what needs to be solved and the means by which you can solve it. It should also demonstrate that you understand the context of the problem and that you have thought through the implications of the research. You need to convince the reviewer (in this case your research advisor and your committee) that your planned project will lead to a meaningful result and will do so in a reasonable amount of time. Writing the research proposal should not become intimidating as it is important to complete this phase of the program in a timely manner. Although it is often necessary to show some preliminary results in the proposal, the bulk of the dissertation research is carried out after its acceptance. The general requirements of a good proposal are to:

1. Convince your advisor and committee that you are qualified to carry out the research project
2. Convince your advisor and committee that the problem is academically and intellectually promising, meaningful and interesting.
3. Convince your advisor and committee that your approach will be carried out successfully and on time. This requires that you give a detailed explanation of your objectives, experimental approach, and timetable.

The following format is suggested for the Research Proposal. Modifications to the format can be made based on the advice and the approval of the research advisor.

### **1. Cover page**

**2. Abstract** – summarize and use concise statements which should that highlight the importance of your project.

**3. Introduction** - state the problem, the context, and your proposed approach

**4. Objectives** - this is the work statement and it may be convenient to present it in the form of interrelated tasks

**5. Background** - This section provides the context in which your work will exist. It should review where the current state of the art is and point out where it is not so that the contribution you propose to make is clear

**6. Approach** - This section builds on the previous one to clarify how you propose to make a contribution based on the context you have defined. The materials, methods, models, etc. you propose to use and the results you expect to achieve should be clearly stated. You should build a case in this section to show that you understand the problem, have a well-reasoned approach for addressing the problem, and have a firm basis for expecting your approach to be fruitful. Finally, based on your review in the previous section you should point out the relative importance of your proposed contribution

**7. Preliminary results and discussion** – Some exploratory research may be needed to confirm that the research area is relevant or promising, or to determine whether the work can be carried

out in the allotted time. Although the preliminary results should not represent a large portion of the proposed project, it is also important that all relevant results to date be included in the proposal.

**8. Timetable** - Divide the work into major tasks which may be listed in bullet form with descriptive detail. A Gantt chart is a very useful tool.

**9. Budget** - The previous task breakdown can be used to determine costs. For many proposals, this section can be an estimate of the cost of materials and equipment. Include the cost of any services and machine time as well as items that are available at no cost.

**10. Appendices** - Anything that does not quite fit into the text because it disrupts the continuity.

**11. References** – Your proposal should include a complete and thorough list of references that are relevant to your research topic. References should be numbered sequentially. Follow reference guidelines established by IEEE, AIP, or others based on guidance from your research advisor and published in styles guides and manuals.

Additional information can be found from RIT's Publishing and Scholarship Support Center at <http://library.rit.edu/userservices/pubschol/>

**Useful links to publication style guides:**

American Institute of Physics (AIP):

<http://www.aip.org/pubservs/style/4thed/toc.html>

Institute of Electrical and Electronic Engineers (IEEE):

<http://standards.ieee.org/guides/style/>

Oxford Press and the American Chemical Society (ACS):

<http://www.oup.com/us/samplechapters/0841234620/?view=usa>

## Using the Library

Each RIT college has a Reference Librarian to serve as liaison. The Reference Librarian for the Kate Gleason College of Engineering is the your first contact for consultation and assistance related to your library and literature research needs. The Publishing and Scholarship Support Center (PSSC) provides writing assistance, copyright consultations, citation assistance and EndNote Web support. There are more than 180 databases licensed by RIT Libraries to support faculty and student research. You will find scholarly information in all disciplines and many resources designed for graduate level research such as Dissertations and Theses and Web of Knowledge. In many cases you will be linked directly to the material in your research area in electronic format. These databases give you access to information that is not available freely on the Internet.

## Qualifying Examination (the Proposal Exam)

The Qualifying Examination is an oral examination based on the dissertation research proposal. The purpose of the exam is to allow the committee to judge the student's ability to execute a research task and to communicate the results. The exam also serves to evaluate the proposed topic to ensure that, if completed as posed, it constitutes an original contribution to knowledge.

### Requirements of the Exam

There are several requirements related to this exam. These include:

- The student is expected to make reasonable and consistent progress toward identifying a PhD dissertation topic, which typically involves performing comprehensive research under the guidance of the advisor.
- Once the student and advisor identify a mutually satisfactory dissertation topic, the student should plan to take the Qualifying Examination.
- The student must complete all course requirements for the PhD degree before taking the Qualifying Examination.
- A student is expected to schedule the Qualifying Examination within two years of passing the Comprehensive Examination, and within three years of beginning the graduate program.
- Examination must occur at least 12 months before the Dissertation Defense Examination.
- A student has a maximum of two attempts to pass the Qualifying Exam. Students may pass this examination and go on to complete the remaining dissertation research with reservations from the proposal committee. If the committee has reservations, a "conditional pass" may be indicated, noting that one or more of the following is expected of the student:
  - completion of additional courses that the committee feels are important for proper preparation
  - continuing the research until a better definition of a proposed topic is presented
  - improving oral presentation skills
  - improving written communication skills
  - other concerns determined by the committee may also apply.

Unless the arrangements for a conditional pass specifically require that the oral presentation be repeated, it generally does not need to be. The committee may also consider the student's proposal and/or presentation to not be of sufficient quality to pass. If this occurs, the committee specifies to the student exactly what is required of the student.

## Qualifying Exam Guidelines

- The student should file a request to take the Qualifying Exam at least two weeks prior to the planned exam
- The Qualifying Exam is a presentation and defense of the Dissertation Proposal
- The only written component of the exam is the proposal, otherwise it is an oral exam.
- The student in consultation with his/her advisor and the advisory committee schedule the date and time for the exam.
- The student should submit copies of the proposal to the advisor, the advisory committee, and the Program Director at least two weeks before the date of the exam
- The student presents his/her proposal in approximately 45 minutes but not exceeding 60 minutes
- Following or during the presentation the committee can ask questions. There is not a limit on the amount of time allowed for questioning after the presentation but the student should not expect less than 60 minutes
- Questions can be directly or indirectly related to the proposal subject
- The advisor will serve as the chair of the qualifying examination committee
- The presentation should focus on the background material pertinent to the proposed dissertation topic and the definition of the dissertation topic
- At the end of the Exam the committee will evaluate the student's performance and inform him/her of the result
- The committee will report the results of the Qualifying Exam to the Program Director

## Research Progress Reports

After taking the Qualifying Exam, students are expected to submit yearly research progress reports to their advisor, advisory committee, and the Program Director. Reports are due to the advisor and in hard-copy form to the program office by the last day of each Spring quarter (week 10) and should be limited to two (2) single-spaced pages summarizing the research progress, milestones, modifications to direction, plan for future work, etc. and should reference the dissertation proposal as necessary. It is expected that more frequent reporting will be carried out between the student and his/her advisor but these yearly reports will serve to establish a record of progress for the student. Copies of the reports will be kept with the students records in the Microsystems Engineering Office.

## Time Management

More often than not, students seriously underestimate the amount of time required to complete a thesis or dissertation project. It is important, therefore, that the student and advisor work together to design a reasonable plan to complete the dissertation research and manuscript. The student should be continuously aware that there are many people that depend on the timely completion of the tasks associated with his/her research project. These include the advisor, the committee, the funding organization, the Program Director, the Dean, journal editors and conference committee chairs if the work is being published or presented, as well as family and friends. Time management is not only important for the tasks associated with the student's research project, it will be a necessary part of the student's professional career as well. The process of writing proposals, conducting research, and reporting results will continue to play a large role in a student's career after completion of the PhD.

Different time management strategies work for different people. Here are some suggestions that may be helpful when conducting research and writing the dissertation. It is recommended that the student and advisor discuss some of these strategies.

- With the help of your advisor, set deadlines for yourself. Stick to the deadlines like your life depended on it. Alternately, give yourself a little bit of wiggle room in your deadlines so that if the occasion arises where you miss one, you have got some of extra time built into your schedule.
- Map out your whole schedule in as detailed a manner as possible. Block out time for all your daily obligations, and include plenty of time for research and writing. If possible, make this a regular schedule.
- Be realistic about how much time you will need. This is a large project and high quality is expected so don't underestimate the time you'll need to devote to this. If you know you are a slow writer or researcher, keep this in mind as you put together your schedule.

## The Candidacy Exam

The Candidacy Exam is administered by the student's advisor and advisory committee between the time that the student passes the Qualifying Exam and he/she registers for the Dissertation Defense. This normally occurs approximately six months prior to the dissertation defense. The student and advisor should schedule the exam with the advisory committee and a convenient time and location. Upon evaluation of the student's progress, the advisor and committee should file a Report of the Candidacy Exam Committee to the Program Director, indicating that the committee is satisfied that there are recommendations for further action.

## The Dissertation

The culmination of a student's hard work toward his/her PhD is the publication of their research. In addition to developing experimental and technical skills during the creation of research, a student needs to acquire the necessary literary skills to communicate results to others. The preparation of the proposal and dissertation manuscripts are the avenue through which these skills are demonstrated. It is also expected that these skills are developed through the publication of technical papers and communications. Adherence to a set of guidelines is necessary so that any research can not only be presented to others but so that it can also be critically reviewed. These guidelines are often strict requirements and it is important that the student realize that adherence and consistency is important. The faculty of the Microsystems Engineering PhD program have developed a set of guidelines that students should follow as they prepare their dissertation manuscript. It is the prerogative of the student's advisor to tailor these guidelines to suit a particular situation and it is the responsibility of the student to follow these requirements. The format of the dissertation should conform to the requirements for publication set forth by the Institute and the Microsystems Engineering PhD program.

To assist with the preparation of the dissertation, students are encouraged to refer to the ACS Style Guide for writing guidelines. This guide provides very useful information regarding getting started, writing style, word usage, grammar, words and phrases to avoid, and the key components of a technical paper.

## Format of the Dissertation

A dissertation manuscript typically has three main components: (1) everything before the main text (the "front matter"); (2) the main text; and (3) everything after the main text (the "back matter").

The cover page, certificate of approval, thesis (dissertation) release and abstract page, form the first four pages of the front matter, as shown in the Dissertation Format Guidelines. Additional pages such as acknowledgements, dedication, and nomenclature are optional. If included, these pages should be in the order listed. The table of contents, list of figures, and list of tables should be placed between the dedication and the nomenclature.

The main text of the dissertation should be divided into chapters which should cover the following sections:

- Introduction
- Background
- Approach
- Results
- Conclusions and Recommendations

In most cases, these sections need to be tailored to the research project and results. You need not always use these names for the various sections, but whatever format used, it must result in a better presentation than would be possible by adhering to that suggested. The back matter should contain the reference, the appendices and an optional author's biography.

## Formatting the Manuscript

### 1. Margins (letter sized paper, 8.5"x11")

Top edge: 1"

Left edge: 1.5"

Right edge: 1"

Bottom edge: 1"

### 2. Page Numbering

- The title page is considered to be page "i", but the number is not typed on it.
- All of the front matter pages are numbered consecutively in lower case Roman numerals placed to the center of the page, 3/4" from the bottom edge.
- The first page of the main text (i.e. the Introduction section) is numbered "1" and all subsequent pages are numbered consecutively in Arabic numerals.
- Page numbering of the back matter should continue consecutively from the numbering of the main text.

### 3. Spacing

Paragraphs should double spaced, no indentation of the first line, left justified or fully justified, and with a hanging indent of 0.5 inch for each paragraph. Headings may be left-aligned or centered; do not fully justify or right-align headings. Single-spacing is allowed for footnotes, endnotes, references, lengthy quotations, bulleted or numbered lists, figure or table captions, or material in an appendix.

### 4. Fonts

- Times Roman font is recommended. Script and ornamental fonts will not be accepted.
- Font size should be from 11 or 12 point. Font size should remain consistent throughout the front matter and main text and must be easily legible.
- Fonts for footnotes, figure captions, table data, references, and material in an appendix or biography are allowed to differ from the main text but style should be compatible.

### 4. Headings

- The font size and style chosen for chapter titles must remain consistent for the titles of all chapters and chapter equivalents.
- Headings may be centered or left-aligned.
- Heading levels must be differentiated from each other. That is, a main-level heading within a chapter must be made readily distinguishable from a sub-level heading within the same chapter by changing alignment (left or center) or capitalization or using a boldface or italic font or through the combination of any of these.

#### EXAMPLE HEADINGS

CHAPTER 1. THIS IS A CHAPTER TITLE

1.1 THIS IS A MAIN-LEVEL HEADING

1.1.1 This is a Sub-level Heading

1.1.1.1 This is a secondary sub-level heading

A section must not have a sub-level heading without first having a main-level heading. Single sub-levels should be avoided. Headings that occur at the bottom of a page (without at least one line of text below the heading) should be moved to the top of the following page.

#### 5. Figures and Tables

- All figures, tables, and other illustrative material must fit within the minimum margins. Manuscript with any material extending beyond these margins will not be accepted.
- Figures and tables must be numbered consecutively throughout the entire thesis. Format may be either a straight sequence (1, 2, 3, etc.) or the decimal system (1.1, 1.2, 1.3, 2.1, 2.2, etc.).
- Figure numbering should be separate from table numbering.
- Figures should be labeled using the fully typed capitalized word “Figure 1” and tables should be numbered with the fully typed capitalized word “Table 1” and so on.
- Figure captions should be single-spaced and are not required to be set in the same font style or size as that of the main text. However, font style and size must remain consistent from one figure caption to the next.
- Figure captions should appear on the same page as the figure to which they refer.
- Figures should not be placed out of the order in which they are numbered.
- Multiple figures may be placed on the same page as long as doing so does not compromise their legibility.

#### 6. References

Number citations consecutively in square brackets [1]. The sentence punctuation follows the brackets [2]. Multiple references [2], [3] are each numbered with separate brackets [1]–[3]. When citing a section in a book, give the relevant page numbers [2]. In sentences, refer simply to the reference number, as in [3]. Do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] shows ... .”

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it is cited; do not put footnotes in the reference list (endnotes). Use letters for table footnotes.

Placing references at the end of this document are in the preferred referencing style. Give all authors’ names; do not use “et al.” unless there are six authors or more. Use a space after authors’ initials. Papers that have not been published should be cited as “unpublished” [4]. Papers that have been submitted for publication should be cited as “submitted for publication” [5]. Papers that have been accepted for publication, but not yet specified for an issue should be cited as “to be published” [6]. Give affiliations and addresses for private communications [7].

Capitalize only the first word in a paper title, except for proper nouns and element symbols. For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [8].

#### EXAMPLE REFERENCES

- [1] G. O. Young, “Synthetic structure of industrial plastics (Book style with paper title and editor),” in *Plastics*, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.
- [2] W.-K. Chen, *Linear Networks and Systems* (Book style). Belmont, CA: Wadsworth, 1993, pp. 123–135.
- [3] H. Poor, *An Introduction to Signal Detection and Estimation*. New York: Springer-Verlag, 1985, ch. 4.

- [4] B. Smith, "An approach to graphs of linear forms (Unpublished work style)," unpublished.
- [5] E. H. Miller, "A note on reflector arrays (Periodical style—Accepted for publication)," IEEE Trans. Antennas Propagat., to be published.
- [6] J. Wang, "Fundamentals of erbium-doped fiber amplifiers arrays (Periodical style—Submitted for publication)," IEEE J. Quantum Electron., submitted for publication.
- [7] C. J. Kaufman, Rocky Mountain Research Lab., Boulder, CO, private communication, May 1995.
- [8] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interfaces(Translation Journals style)," IEEE Transl. J. Magn.Jpn., vol. 2, Aug. 1987, pp. 740–741 [Dig. 9th Annu. Conf. Magnetism Japan, 1982, p. 301].

## 7. Appendix

- The appendix is a section that is placed near the end of the thesis and may contain material such as tables, figures, maps, photographs, raw data, computer programs, and many other types of material that detract from the continuity of the main text or are too lengthy.
- The appendix title should be formatted like a chapter title and headings should be formatted in a manner consistent with headings found in the main text.
- Material in an appendix may be single-spaced.
- If there is more than one appendix, they should be numbered as A, B, C, and so on. Each appendix should started on a new page.

Additional information can be found from RIT's Publishing and Scholarship Support Center at <http://library.rit.edu/userservices/pubschol/>

### Useful links to publication style guides:

American Institute of Physics (AIP):

<http://www.aip.org/pubservs/style/4thed/toc.html>

Institute of Electrical and Electronic Engineers (IEEE):

<http://standards.ieee.org/guides/style/>

Oxford Press and the American Chemical Society (ACS):

<http://www.oup.com/us/samplechapters/0841234620/?view=usa>

## The Dissertation Exam (the PhD Dissertation Defense)

The dissertation defense can be scheduled only after all course requirements for the degree have been successfully completed. The research advisor, on behalf of the student and the student's advisory committee should notify the Program Director of the scheduling of the final examination of the dissertation by forwarding the title and abstract of the dissertation and the scheduled date, time, and location of the examination. The final examination of the dissertation should not be scheduled within six months of the date on which the student passed the Candidacy Exam or less than one year of the date on which the student passed the Qualifying Exam.

Barring exceptional circumstances (requiring permission from the Program Director), the examination may not be scheduled sooner than four weeks after formal announcement via hallway postings and email broadcast.

### Preliminary Steps

When you and your advisor have agreed that you are ready for the defense of your dissertation, you should submit copies of your dissertation manuscript to all committee members and the Program Director. You should expect that there could be considerable re-writing after this draft submission. You should allow at least three weeks for your committee members to read the manuscript and comment. Depending on the nature of the comments, you will need to plan sufficient time for re-writing. It is in your interest to keep in very close contact with all committee members, so you can anticipate their remarks and accommodate them as much as possible in the draft stage.

The Program Director may provide feedback on the content as well as format. Thus the draft copy should conform to all the regulations regarding the dissertation manuscript presentation. Any remarks by the Program Director should also be incorporated in the final document.

### Scheduling the Defense

After you have finished re-writing, you should re-submit the manuscript to the committee members and set up a convenient date for your defense. The Program Director must also be consulted. This date cannot be earlier than four weeks from the day you contact the Program Director. It is your responsibility to contact your committee and inform them of the arrangements and to post as required. The email broadcast announcement should be coordinated with the program office. The thesis examination will be held at RIT at a location that is convenient to the committee members and the targeted audience.

### The Exam Process

The first part of the examination is open to the public as should be advertised in advance. It comprises a presentation and is primarily a defense of the dissertation research in the form of a seminar, with visual aids as appropriate. It is expected not to exceed one hour, including approximately 45-50 minutes of presentation followed by 10-15 minutes for questions. During the talk, the following points must be addressed: objectives and accomplishments of the research; what

is the problem; why is it relevant; what approach was taken and why; what were the results and conclusions. It is expected that the candidate will make a verbal presentation with only occasional reference to written notes.

After the end of the presentation, the committee will examine the candidate in a closed meeting. The Program Director will also attend. The examination is primarily concerned with the research dissertation work, but it is also of the nature of a final certification of the student's overall knowledge for the degree. Questions may relate to any aspect of the material in the research area and in the coursework of the degree program.

The committee examination usually lasts about one hour, at the end of which the candidate will be asked to leave the examination room while the committee discuss their the exam and their decision. After a decision has been reached, the candidate is invited back into the room. In the case of failure, the candidate will be advised as to what actions can be pursued.

## Signatures

Upon successful completion of the examination, the necessary signature pages of each copy are signed by the appropriate persons. Original signatures must be on all copies. Securing the signatures is the student's responsibility; it is best done immediately after the defense.

Make sure that all copies conform to the standard format and that you have enough copies. Then take all the copies to the Program Director for signature. This last student signature grants permission to have the thesis bound. Follow the procedure for thesis binding as outlined in "Preparation of the Dissertation for Binding" which follows.

## Publishing the Dissertation

There are several requirements and guidelines pertaining to the publication of the dissertation manuscript.

## Copyright Law and Graduate Research

The graduate student thesis is copyright protected material and some familiarity with copyright rules and responsibilities is a good idea. Copyright law establishes certain rights and ownership to the creator of original art, text, figures, etc. Additionally, during the course of research and publication, the meaning of “fair use” and “copyright infringement” should be understood. Copyright law will become increasingly important throughout a student's academic as well as professional career. Students should read and understand the materials on Copyright Law and Graduate Research available from RIT's Publishing and Scholarship Support Center.

## Preparation of the Dissertation for Binding

Following are some requirements that should be adhered to in preparing your dissertation manuscript for binding:

- The paper for the RIT Archives copy must be 100% cotton bond (acid-free).
- All copies should be high quality. Laser copies are preferable, although many ink jet printers also produce acceptable copies. High quality photocopies are also acceptable.
- The Thesis/Dissertation Author Permission Statement should include print reproduction and submission to the RIT Digital Media Library. (A copy of this form can be found at: <http://library.rit.edu> (Publishing/ Publishing & Scholarship Support/ Graduate Student Support))
- A PDF of the form should accompany the electronic version of your thesis/dissertation.
- Your thesis/dissertation must be signed and dated by the Program Director and/or your graduate advisor before it may be bound. An unsigned thesis/dissertation will not be accepted for binding.
- The spine title should include the title, the author's last name and the year of acceptance for degree requirements and total no more than 96 characters in length (including spaces). If your title is longer than 96 characters, please create an abbreviated title that will be used for the spine only.
- You are responsible for making copies of your thesis/dissertation for binding.
- Collate, separate and clearly identify each copy before you bring them to the Library.
- All copies must be submitted at the same time.
- The Library will retain one copy, preferably an original, for the RIT Archives.

Bring the following to the Publishing and Scholarship Support Center when dropping off your thesis/dissertation for binding:

- 1 copy of your thesis/dissertation for the RIT Archives (the Library)
- Copy/copies of your thesis/dissertation for yourself
- Copy/copies of your thesis/dissertation for the advisor and the program
- Paid receipts (1 pink, 1 white) from the Bursar's Office (1138 Eastman)

- The name, phone number or e-mail of individual picking up your copies

You are responsible for paying the binding fee (\$13 ea.) for any copies other than the RIT Archives copy and those that are paid for by the program (4). The binding of your thesis/dissertation copies takes approximately 2-4 weeks. Bindery shipments are sent and received on alternate Thursdays. The designated pickup person will be notified when your copies return from the bindery. The RIT Archive's copy will be catalogued in Einstein (RIT Libraries Catalog), World Cat, and shelved in the RIT Archives.

## Publishing Your Dissertation in ProQuest/UMI

It is required that all RIT theses and dissertations be submitted to ProQuest/UMI. This database includes citations for materials ranging from the first U.S. dissertation accepted since 1861. RIT offers this database to members of the RIT community through a paid subscription each year. To include your thesis/dissertation in the database, there is a standard fee of \$55 for a thesis or \$65 for a dissertation.

To publish your work in the Proquest/UMI database you will need the following items: full-text of the abstract and thesis/dissertation in PDF format, supplementary files, advisor's and other committee members' names, the subject category for your department, and keywords.

For more information about publishing your work, please refer to the Proquest/UMI thesis/dissertation submission website.

## RIT Digital Media Library (DML)

The Publishing and Scholarship Support Center will automatically provide Open Access for your thesis/dissertation in the RIT Digital Media Library (DML) at no cost to you. For more information about the DML please click on the following link: [RIT Digital Media Library](#).

## Degree Certification

A student should fill out and submit to the Program Office an Intent to Graduate Form when he/she is within four quarters of graduation. After you have finished with your thesis you must take the following steps in order to graduate.

1. Obtain a form signed by the Program Director that the thesis has been successfully defended. This form will only be signed after the bound copies of your thesis have been delivered to the Library and the Microsystems Engineering program office.
2. Obtain a signed form "Termination of Research Activity" from your research advisor.
3. Submit these two forms together with a request to initiate the PhD degree certification to the Microsystems Engineering program office.

Certification of any graduate degree requires that the student has achieved a minimum program cumulative grade point average of 3.00 (a B average). Full payment or satisfactory adjustment of all financial obligations is also required for certification.

## Additional Information

All RIT policies and regulations apply in full to the Microsystems Engineering PhD program. The Institute Policies and Procedures manual can be found at <http://www.rit.edu/~w-aa/Manual/>. This manual provides the general and educational policies and procedures of the Institute, including information related to students, faculty, staff, and administrators as well as the vision and goals of the Institute. A few of the RIT and Microsystems Engineering policies are given here to provide guidance for the student.

## The Institute Calendar

RIT runs on the quarter system calendar with four (4) ten-week terms throughout the year. The current and upcoming Institute Calendar can be found at <http://www.rit.edu/calendar/>, together with an event calendar, commencement information, and the employee holiday schedule.

## Student Records

Student records are housed in the Kate Gleason College of Engineering and in the Microsystems Engineering PhD program office. Administrative support is available to students through this offices in areas of registration, course selection, scheduling, records, and program advisement.

In accordance with the Family Educational Rights and Privacy Act of 1974 (commonly known as the Buckley Amendment), RIT students have the right to inspect, review and challenge the accuracy of official educational records. RIT policy ensures that only proper use is made of such records. With the exception of copies made for internal use (provided by the registrar for advising purposes), copies of a student's permanent record (transcript) or non-public information from student records will not be released without the student's written consent. Official written requests from students must be made for transcript release.

Directory information may be released at any time to persons or agencies indicating a legitimate interest. *Directory Information* includes the following: a student's name, mailing address and telephone number, date and place of birth, major field of study, participation records in official RIT activities and sports, weight and height if a member of an athletic team, dates of attendance at RIT, degrees and awards received.

## Course Work Policies

### A. Repeating Courses

Graduate courses cannot be repeated to improve a grade.

### B. Credit by Examination

With the approval of the Program Director, students with undergraduate degrees in engineering (or related fields) from RIT can request credit by examination for certain graduate courses offered by the Program, provided there is substantial curriculum overlap with the corresponding

undergraduate course. Credit for graduate courses also may occasionally be granted by examination in the event that the student petitions an instructor to administer the exam.

#### C. Course Exemption

An instructor may recommend approval of a course requirement exemption based upon previous experience or course work. However, this exemption does not alter the total credit requirement for the degree program. Requests for course exemption must be initiated by the student, in writing, to the Program Director. Approval of the request is subject to graduate faculty consensus.

#### E. Class Attendance

No record of attendance is kept by the Microsystems Engineering PhD Program administrative offices. Reports of absences are not required. However, a record of absences may be kept by any faculty member and may be used by that faculty member to determine a grade. Non-attendance does not constitute withdrawing from a class.

## Definition of Grades

The following list indicates the number of quality points awarded according to the grade received. These total quality points are averaged to calculate the grade point average:

- Grade of A (Excellent) = 4 quality points
- Grade of B (Good) = 3 quality points
- Grade of C (Satisfactory) = 2 quality points
- Grade of D (Minimum Passing) = 1 quality point
- Grade of E (Conditional Fail)\* = 0 quality points
- Grade of F (Failure)\*\* = 0 quality points

The Grades I,R,S,W,Z do not affect GPA calculation and are explained below.

Blank - If a student officially drops a course or courses during the first 6 days of the quarter, but remains registered for at least one course, no course numbers, credit hours, grades or quality points are officially recorded for those dropped courses.

(I) - Incomplete is a temporary grade which is given when an instructor grants that the conditions for a student's inability to complete a course are beyond the control of that individual. The due date for the completion of the course requirements, not to exceed two quarters, is set by the instructor. The student is advised in writing of the date and the conditions under which the work must be completed. If a "Change of Grade" form is not received by the Registrar's Office by the end of the second succeeding quarter, the incomplete grade automatically becomes an "F". The course must then be repeated in order for the student to receive credit. The Program will not pay tuition for the repeated course.

(F) - "F" - is a failing grade and does not count towards the completion of course requirements, the accumulation of credits or quality points, or residency requirements.

(W) - Withdrawn - A "W" is assigned to indicate withdrawal from a course. Withdrawal forms are available from the records office and must be completed by the student and signed by the instructor and the Program Director in the student's department before the end of the eighth week of class. Withdrawals after the eighth week must be approved by the Director of the Program and must be accompanied by a rationale containing unusual circumstances beyond the control of the student.

A student must officially withdraw from a course he or she does not intend to complete. If no official withdrawal action is recorded and the student's name appears on the grade roster, a grade of "F" is assigned.

When students "drop" a course within the first six days of class there is a full tuition refund. Pro-rated refunds that decline weekly are provided by the Bursar for official withdrawals completed within the first four weeks of the quarter. Drops after four weeks receive no tuition refund

(Z) - Audit - This grade indicates that the student has audited a course. A student may register to audit a course at any point during the registration period. However, a permission to audit form must accompany the registration. This form also includes a space to convert a registration to audit a course to a registration for credit or the reverse. This option can only be used during the first six days of the quarter. One half tuition is charged for courses audited. The credit represented by the audited course does not count towards a student's full-time status nor does it count towards a residency requirement. However, if the audited course contributes to a credit count of more than 18 credits,

half tuition per credit over 18 will be charged. An audited course does not bear credit and does not satisfy a program course requirement.

(R) - Registered - A permanent grade which indicates that a student has registered for a course but has yet to meet the total requirements of a continuing course, such as a graduate thesis or dissertation work for a graduate paper. Re-enrollment in the same course occurs for several quarters. Completion of work represented by the "R" will be noted by having the approved thesis/dissertation title, as received by the registrar from the program, recorded on the student's official transcript using the words "Thesis Accepted/Dissertation Accepted." "R" graded courses are allowed in the calculation of the residency requirement for graduate programs.

(E) - The "E" Grade is a temporary grade given in the first or second quarter of a two or three quarter course sequence. If the course which follows the "E" graded course is passed with a "D" or above, the "E" grade is converted to a "D". If a failing grade is assigned to the course which follows, the "E" grade is converted to an "F".

(S) - Satisfactory - Upon acceptable completion and defense of thesis, the student will be granted this grade for the continuation of thesis course. Courses bearing the "S" grade do not effect a student's GPA, do not count as credit toward the total necessary for graduation and are not considered toward the residency requirement.

(T) - Transfer (credit) - Any student with previous graduate level work may petition the graduate faculty through the Program Director for transfer credit. Any such coursework cannot be part of a degree that has been already awarded. A maximum of six quarter credits, transfer or otherwise, can be taken outside Microsystems Engineering. Transfer credit is awarded on a course-by-course basis. Credit is granted for previously completed courses earning a grade of "B" or above from accredited institutions only. The grades for these courses are not figured into a student's RIT GPA and are not counted towards a residency requirement. The credit is, however, included in the total count towards the degree requirements.

Credit by Examination does not effect a student's RIT GPA nor does it count towards the residency requirement. This strategy cannot be used to replace a "D" or "F" grade. Credit achieved through successful completion of an examination does count towards a student's degree requirements.

Change of Grade - Following a faculty member's report of grades, it is not within the right of any person to change a grade unless an error is shown in the computation or recording of that grade. If an error has been made, the faculty member must complete the appropriate Change of Grade form which is to be officially signed by faculty member and department head, stamped by the records secretary, and submitted to the Registrar. An appeals procedure is available to students who wish to dispute a grade after consulting with the instructor of the course. The next level of the appeals process is with the Academic Conduct Committee of the Microsystems Engineering PhD. A final appeal is made with the Institute Hearing and Appeals Board.

All course grades are considered when calculating a grade point average. Permission from the Coordinator of the Graduate program must be granted to a student who wishes to repeat a course.

## Grade Point Average

There are two categories of grade point average calculation for graduate students:

1. RIT - quarterly, yearly and cumulative
2. Program - quarterly, yearly and cumulative

The RIT averages will reflect all RIT course work completed at or above the 100 course-number level with a grade of A, B, C, D, E, or F. Whenever the RIT averages are produced, the number of diploma credits and diploma quality points are also noted.

The program average reflects any course work completed at RIT which is applicable to the requirements of the academic program in Imaging Science. Graduation criteria are based on the student's program cumulative GPA.

Note: In most instances, the program GPA and the RIT GPA are identical. When a student changes a major or takes electives not applicable to a degree program, the program and RIT GPA may differ.

The Quarterly Grade Point Average reflects a single quarter of academic activity and includes all course work completed for credit at RIT during that quarter.

The Yearly Grade Point Average reflects the student's academic activity for each year, ending with spring quarter and including the previous summer quarter. The primary purpose of this computation is to consider part-time students for the Dean's List at the end of spring quarter.

The Cumulative Grade Point Average reflects the sum total of the course work completed at RIT. This calculation is updated each quarter a student is in attendance.

Exception: A student who completes undergraduate studies at RIT and then engages in graduate program will begin a new record and cumulative GPA upon matriculation as a graduate student.

## Academic Probation and Suspension Policy

Matriculated graduate full-time and part-time degree students will be placed on probation or suspended from the Institute according to the criteria enumerated below. All actions are taken at the end of the quarter; however, a student may petition the Director of the Program for reconsideration of probation or suspension should the removal of an incomplete grade (I) raise the Program Grade Point Average above those stated below. Each matriculated graduate student will generate two different grade point averages. The Institute average reflects all course work completed at RIT. The Program average reflects course work completed at RIT applicable to graduation in a student's current academic program. The current academic program refers to degree course requirements specified by the degree granting college and noted in the graduate catalog.

(a.) Any matriculated graduate student whose Program Cumulative Grade Point Average falls below a 3.00 ("B" average) after 12 quarter credit hours or subsequently will be on probation and counseled by the departmental advisor concerning continuation in the graduate program.

(b.) Those students placed on probation must raise their Program Cumulative Grade Point Average to the 3.00 level within 12 quarter hours (one full-time quarter) or be suspended from the graduate program.

(c.) Should it be necessary to suspend a graduate student for academic reasons, the student may apply for readmission to the Director of the Program or designee (department head, program director, coordinator, etc.) upon demonstration of adequate reason for readmission.

## Re-Admission Policy

If a student has become inactive (has not completed a course in four quarters) or has withdrawn from RIT, Institute policy requires the student to reapply for admission. Re-admission applications are handled according to the following policy.

1. Students who left the program with a GPA of 3.0 or better (in good standing) and will return to the program within two years of the time their last course was completed, will be readmitted to the program upon reapplication.
2. Students who left the program with a GPA of 3.0 or better and return to the program more than two years after the last course was completed, must meet current admission standards upon reapplication. The program of study shall be subject to review and will be rewritten. Previous waiver and/or transfer credit may be lost and program deficiencies may need to be made up.
3. In addition, each college will have the responsibility, upon readmission, of determining which previous courses, if any, will be applicable toward the degree.
4. In all cases, students must complete the program within seven years of the date of the oldest course counted toward their program. This does not apply to prerequisites, Bridge Program courses in computer science, Foundation courses or similar requirements in other departments. This policy took effect on September 1, 1984. In the case of doctoral students the seven-year period starts at the time the student first attempts the comprehensive exam.

### RIT's Continuation of Thesis / Dissertation Policy

If a student has completed thesis/dissertation course work but has not finished the thesis/dissertation itself, it is the responsibility of the student to register each quarter for a one quarter hour Continuation of Thesis/Dissertation course. The Program may offer students one quarter extension of time before the Continuation of Thesis/Dissertation tuition is levied. For the quarter in which the Continuation of Thesis/Dissertation tuition is not to apply, the student will register for "0" hours. Payment of all Continuation of Thesis/Dissertation tuition is waived for all summer quarters.

Once work has begun on a thesis/dissertation, it is seen as a continuous process until all requirements are completed. It is the student's responsibility to register each quarter for a one quarter hour Continuation of Thesis/Dissertation course if the student has completed the program thesis course work but not the thesis itself.

Students will be responsible to register each quarter and pay one quarter hour of Continuation of Thesis/Dissertation tuition after they have completed the thesis/dissertation credits required by their program. If the student does not register for the Continuation of Thesis/Dissertation course for one quarter hour of credit, the program may either:

- a) Register the student for "0" credits (using a drop/add form) for which no tuition is assessed in order to maintain registration for one quarter only, excluding summer or
- b) Remove the student from the program