

# The Ph.D. Degree in Information Science - Telecommunications Concentration

Telecommunications Program Committee

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## 1 Purpose of the Degree

The Doctor of Philosophy (Ph.D.) degree in Information Science -Telecommunications Concentration (henceforth called Ph.D. in Telecommunications for short) prepares students for independently engaging in advanced work in high-quality research and teaching. It provides research oriented graduate study and professional specialization in telecommunications and emphasizes both scholarly and applied research. To earn a Ph.D. degree, a student must demonstrate breadth of knowledge, give evidence of superior scholarship and mastery of a specialized field, and must demonstrate his/her ability to do significant and relevant research. In addition, the student must conceive, write and defend a Ph.D. dissertation representing a significant and original contribution to current academic research as demonstrated by a public dissertation defense and publication in established peer-reviewed academic conferences and/or journals. Major milestones en-route to the Ph.D. degree are the preliminary examination, the comprehensive examination, the dissertation proposal, and the dissertation defense.

## 2 Overview of the Degree Requirements

A student pursuing a Ph.D. degree is first admitted to graduate study in Telecommunications. A minimum of 48 credits beyond a master's degree are required. Exceptional students with a technical bachelor's degree may be admitted on occasion and in such cases, a minimum of 72 credits beyond the baccalaureate degree is required. Included in these credits are graduate and seminar credits *beyond* the master's degree or its equivalent and at least 18 dissertation credits. *While these are minimum credit requirements, a Ph.D. student may be required to take more credits of*

*coursework to obtain the breadth and depth needed to successfully complete their dissertation.* During the first or second term of study and in preparation for the preliminary examination, all telecommunications Ph.D. students must attend the Ph.D. orientation session (a two-hour review of the requirements for the Ph.D. degree).

Every student must complete the preliminary examination within four semesters of his/her admission (not counting Summer) into the program unless an exception is granted by the Telecommunications and Networking Program Committee (TPC). Exceptions are typically not allowed for full-time students. Exceptions may be made for part-time Ph.D. students in consultation with their advisors. The preliminary examination consists of authorship, presentation, and public defense of a publishable quality research paper as described below.

A student who successfully passes the preliminary examination is admitted to the Doctoral Program in Telecommunications. The student must now prepare for the comprehensive examination. Prior to the comprehensive examination a student must complete most of the course and seminar requirements. This includes 12 credits of doctoral level classes (as determined by the advisor), 6-credits of minor requirement and 12 credits in doctoral seminars in relevant topics. After completing most<sup>1</sup> of these requirements the student is eligible to apply to take the comprehensive examination.

For the comprehensive examination the student is required to write a “state-of-the-art” tutorial paper that provides a comprehensive literature survey, critique and explanation of the topic considered in the paper. This paper must be submitted to the Telecommunications Program Committee (TPC) two weeks prior to the scheduled oral examination date. The oral part of the exam is directed primarily at the contents of the “state-of-the-art” paper, but questions in a larger context about the various relationships among the principal components of telecommunications may also be asked. In most cases the paper also provides the background from which the student’s dissertation research begins. Students are encouraged to perform additional work on the ‘state-of-the-art’ paper and submit it to a peer reviewed journal or conference. In some cases, a student may wish to enlarge the “state-of-the-art” paper and submit it as a dissertation proposal. The comprehensive examination is a one-hour oral examination. Its primary function is to assess the student’s ability to: (1) synthesize the theory, the research, and the important contributions which have shaped the field; (2) apply research methodologies to telecommunications topics; and (3) show the inter-relationships among the structural components of the field and how research advances our understanding of

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<sup>1</sup>“Most” here refers to the completion of every requirement. Occasionally, a student can apply to take the comprehensive exam if a minority of the course/seminar requirements are yet to be fulfilled with approval from their advisor

these relationships.

After successfully completing the comprehensive examination, the student is admitted to doctoral candidacy and works with a faculty advisor to prepare a dissertation proposal and form a dissertation committee. The dissertation proposal must be approved by the student's dissertation committee. Successful completion of the comprehensive examination and approval of the dissertation proposal permit the student's academic advisor to recommend the student for doctoral candidacy. Normally a student will begin to register for dissertation credits after being admitted to doctoral candidacy. A minimum of 18 dissertation credits is required. To be eligible for the dissertation defense the student must complete the residency requirement (three terms of full-time study of which two terms must be consecutive). The final defense of the dissertation is a public session announced in University-wide media. The dissertation must be unanimously approved by the dissertation committee.

### **3 Admission Requirements**

The following are requirements for admission to graduate study in Telecommunications for pursuing a Ph.D. degree.

1. A master's degree from an accredited university, a recognized international program, or the equivalent. Students must submit official transcripts as evidence. Exceptional students with a technical Bachelor's degree may be admitted on occasion. Such students must still satisfy all other requirements that follow.
2. Attainment in graduate work of a minimum quality point average of 3.3 (on a scale with A having a value of 4 points per credit). An international student's quality point average will be calculated on the basis of equivalency from universities that use a different scale.
3. Submission of scores from the Graduate Record Examination (GRE) taken within three years of the application. Scores on all three sections (verbal, quantitative, and analytical) of the GRE must be submitted.
4. At least three references from persons in the professional and academic communities. The TPC may, on occasion, require additional references.
5. Submission of an application fee determined by the School of Information Sciences.

6. As evidence of the ability to undertake doctoral work, an essay (not exceeding 1,000 words) indicating, as specifically as possible, the student's academic and professional goals in relation to the Telecommunications doctoral program and identifying potential areas and/or topics in which the student expects to pursue dissertation research.
7. Evidence of academic completion of:
  - Two different scientific computer programming languages,
  - Introductory class in probability and statistics
  - Differential and integral calculus

In addition, a candidate may elect to include the following optional material:

1. A complete curriculum vitae that provides an overview of education, work, publication, and other professional activities.
2. An example of published writing.
3. A description of any published or unpublished research, contributions to the professional or scholarly literature, and other professional or academic experience relevant to an assessment of his or her capacity to pursue doctoral study successfully.

All materials must be submitted to the on line admission site.

Applications from all individuals, regardless of citizenship, who have a degree from a non-U.S. institution must be reviewed by the University Office of International Services (OIS) prior to their review by the TPC.

International students must submit evidence of competence in the English language. A minimum score of 550 (paper-based) or 80 (Internet-based) on the TOEFL is required for admission. Students may choose to take the International English Language Testing System exam (IELTS) in place of the TOEFL. Students should receive a minimum result of Band 6.5 on the IELTS. In addition, University policy requires that all international students be retested on English language abilities upon arrival at the University of Pittsburgh.

Credentials of prospective students are reviewed by the TPC and voted upon by those members.

Students whose complete credentials are not available for full admission may register as special students until the completed credentials are received, provided all other requirements have been satisfied. Students with deficiencies in either coursework or scholastic achievement may be admitted provisionally. Prerequisite courses should be completed within the first two terms.

## **4 Matriculation**

A student is said to have matriculated upon admission and enrollment into the program.

### **4.1 Academic Advising and Plan of Studies**

An advisor will be assigned to the student upon entering the program but students are free to select a different advisor for subsequent advising and registration as their interests become more focused. The Ph.D. student should seek a faculty program advisor who is knowledgeable in the student's major area of study. The advisor must be a member of the graduate faculty and the TPC who is able to spend the time and effort necessary for the advising role, will be available for examinations, and with whom a productive and comfortable working relationship can be established. The advisor selected by the student for the period prior to the dissertation stage of the program is the program advisor. The program advisor and the dissertation advisor may be the same person, but the student has the option to select a different advisor for the dissertation. A list of graduate faculty and their respective research interests is available at the Ischool web site.

### **4.2 Program Advisor**

Upon agreement of the faculty member to act as the student's advisor, the signed agreement is placed in the student's folder. Any subsequent change of program advisor should be submitted in writing to the Chair of the TPC and placed on record in the student's folder.

Doctoral students are ultimately responsible for their own direction and progress through the program and are encouraged to seek advice from any member of the SIS faculty or other University faculty in this endeavor. The program advisor, however, is the one primarily responsible for providing guidance, insight, advice, information, explanation of University and School policies, and general assistance in the pursuit of the Ph.D. degree. The program advisor will also approve those actions requiring a faculty signature. All coursework and dissertation credits must be approved by an advisor.

The program advisor assists the student in 1) developing a plan for the program of studies and 2) arranging for the preliminary and the comprehensive examinations.

### **4.3 Plan of Studies**

A candidate for the Ph.D. should have broad knowledge of the field of Telecommunications as well as a specialization in the area of major interest. Every candidate should have, in addition, a strong background in research methodologies.

A plan of study should be designed by the advisor and student as early as possible after admission. A copy of the plan of study must be on file in the student's folder and should be consulted during each registration.

In the doctoral program, at least 26 credits must be doctoral level courses and seminars with at least 12 credits of doctoral seminars. Some courses at the masters degree levels are also appropriate for doctoral study. Courses at the undergraduate level do not meet the minimum requirements for doctoral study although they may be taken to supplement a particular program of study.

## **5 Degree Requirements**

### **5.1 Credit Requirements**

The Telecommunications Ph.D. program requires a minimum of 48 credits beyond a master's degree. Exceptional students with a technical bachelor's degree may be admitted on occasion and in such cases, a minimum of 72 credits beyond the baccalaureate degree is required. These credits must include 6 credits of minor courses, 12 credits of doctoral level seminars in relevant topics and at least 18 credits of dissertation research and writing; however, regardless of the number of credits taken, no more than 18 credits for dissertation research and writing may be applied toward graduation. The grade for these credits will appear as an "S" on the student's transcript. While these are minimum credit requirements, every Ph.D. student may be required to take more credits of coursework to obtain the breadth and depth of knowledge required to successfully complete their dissertations. Graduation depends upon meeting the minimum credit requirements and all other requirements.

Graduate degrees are conferred only on those students who have completed all courses required for the degree with at least a 3.3 QPA. Grades of C or lower are unacceptable for graduation credit.

All students who are candidates for doctoral degrees are governed by the regulations of the University Council on Graduate Study, which establishes minimum standards for graduate work throughout the University as well as by those regulations established by the SIS faculty.

## **5.2 Doctoral Level Courses**

Each student must complete 12 credits of doctoral level courses (which are determined by the TPC). Example courses include Wide Area Networks, Network Science, Queueing Theory, Foundations of Wireless Communications. The advisor in consultation with the TPC determines the courses acceptable as relevant doctoral courses. Doctoral seminars can be substituted for doctoral level courses with approval from the advisor.

## **5.3 Minor**

In consultation with the advisor, each student must complete at least two courses in a minor discipline. The goal of the minor is to enable the student to have background in an area useful toward the dissertation research, but not in Telecommunications. Students with a master's degree in a related field may apply their masters courses towards fulfilling the minor requirement. This is not equivalent to transfer of credits. Elementary courses and courses that are tightly linked to Telecommunications are not acceptable for this requirement.

## **5.4 Doctoral Seminar**

The doctoral seminar requirement can be fulfilled by four doctoral seminars (12 credits) in Telecommunications or alternative seminars in Information Science, Electrical Engineering or Computer Science. At least two doctoral seminar must be in Telecommunications.

# **6 Residence and Registration Requirements**

Full-time study on campus is considered most beneficial to students, but it is recognized that students may have off-campus responsibilities as well. The Ph.D. degree, therefore, can be completed by a combination of full-time and part-time study. Three terms of full-time study are required, two of which must be consecutive and must be taken after successful completion of the preliminary examination. Full-time study is defined as nine or more graduate credits per term. All students, whether on campus or away, must maintain active status by registering according to the requirements stated in the next section of this document.

Doctoral students in residence must register for at least 3 credits in each term until they have achieved candidacy.

To maintain active status, all doctoral students not in residence must be registered for a minimum of 3 credits in each 12-month period (3 credits in one term or 1

credit in each of three terms) from the time of admission to candidacy until receipt of degree.

A student who fails to register for at least one of three consecutive terms will be automatically placed on inactive status and will be required to apply for readmission in order to continue graduate study. Upon readmission, the student is required to adjust the program of studies to meet current Ph.D. degree program, School, and University requirements.

In keeping with University policy, all graduate students must be enrolled for a minimum of 1 credit in the term in which the student graduates.

Doctoral students who have completed all credit requirements for the Ph.D. degree, including minimum dissertation credit requirements, and are working full time on their dissertations, should register for "Full-time Dissertation Study". Enrollment in this course fulfills the University requirements for registration in the term of graduation and for 3 credits in the year of graduation.

## **6.1 Probation and Termination**

All students pursuing the doctoral degree are required to maintain a cumulative QPA of at least 3.3 after admission to graduate study and for all coursework applicable to the degree. Students are automatically placed on academic probation when their cumulative QPA falls below 3.3. The TPC may choose to terminate students on probation for two consecutive terms. A cumulative QPA of 3.3 or better is required for admission to doctoral study and for the award of the doctoral degree.

## **6.2 Transfer of Credits**

Upon petition to the TPC and with the consent of the program advisor, a maximum of six graduate credits which can be applied as electives may be transferred. This credit for graduate coursework completed at another institution may be granted if the credit has not been applied to a previous degree, has been earned within the 6-year statute of limitations, and is relevant to the student's doctoral studies in the Telecommunications and Networking Program. Advanced standing is granted at the time of admission or during the first term of coursework, if approved. Petitions for transfer of credits must be received at the time of application or during the first term of attendance. Transcripts verifying the graduate courses must accompany the petition along with sufficient documentation to permit the faculty to evaluate their relevance to the doctoral program.

Transfer credits must be earned at an accredited institution granting degrees at the doctoral level. No credit will be granted toward doctoral degrees for work

completed in extension courses or in off-campus centers of another institution unless those credits are approved for graduate degrees at that institution. Transfer credits will not be accepted for courses in which a grade lower than a “B,” or its equivalent, has been received.

Transfer credits are entered on the student’s transcripts as block credits; grades (and quality points) are not recorded for credits by transfer.

## **7 Preliminary Examination**

The preliminary examination, according to Regulations Governing Graduate Study at the University of Pittsburgh, is held:

... to assess the breadth of the student’s knowledge of the discipline, the student’s achievement during the first year of graduate study, and the potential to apply research methods independently. . . . The evaluation is used to identify those students who may be expected to complete a doctoral program successfully and also to reveal areas of weakness in the student’s preparation.

The TPC has clarified further that the overall objectives of the preliminary examination are:

1. To test the Ph.D. students for breadth of knowledge
2. To evaluate their skills, and their ability to apply them
3. To evaluate their ability to conduct research.

The evidence of a student’s breath of knowledge is determined through their performance in the doctoral level courses and seminars. The evidence of the ability to conduct research is provided by authorship, presentation, and public defense of a publishable quality research paper that (a) presents work the student has done under the direction of a graduate faculty member in the program; (b) demonstrates the student’s ability to conduct research and clearly report the results of that research (c) shows the student’s mastery of the subject matter, both in the written paper and in the oral presentation and defense.

### **7.1 Eligibility**

To be admitted to the preliminary examination a student must:

1. Have completed a master's degree in a closely related field (e.g., telecommunications, information science, computer science, engineering, mathematics); Exceptional students admitted after a Bachelor's degree must have completed all pre-requisite coursework.
2. Be admitted to full graduate status (i.e., all provisional admission requirements must be completed);
3. Have attended the Ph.D. orientation session;
4. Be registered in the term in which the preliminary examination is taken; and
5. Apply in writing and with the advice and consent of a faculty advisor to the secretary of the TPC by the announced deadline.

Traditional preparation for the preliminary examination includes graduate-level coursework and familiarity with reading and reviewing papers and identifying research gaps. In addition, doctoral students should become familiar with the proceedings of the relevant professional societies of the field and copies of recent preliminary examination papers available from the secretary of TPC.

## **7.2 Registration Requirements**

Students must be registered in the term in which their preliminary examination is to be completed.

## **7.3 Process**

The preliminary examination is a single examination that every student must complete within four semesters of his/her admission into the program (not including Summer) unless an allowable exception (detailed below) exists.

### **7.3.1 Content and Format**

The preliminary examination consists of two parts:

**Research Project and Paper:** During the first year of doctoral study, under the direction of the advisor (or another full or adjunct member of the program's graduate faculty), students will design and complete a research project. The project should reflect only those activities undertaken during the first year of study. A previous master's thesis or other work completed prior to the start of doctoral study may not be submitted for this requirement. While much research involves working in

a larger team, the student's role in the project and in writing the paper should be significant. The student must be the primary author, and ideally should be the sole author. The student should seek a project or a part of a project in which the student can take the lead in conducting the research and writing up the results under the direction of the advisor. However, unlike a dissertation or thesis, the research paper submitted for the preliminary evaluation may include co-authors. In this case, the role of each co-author should be clearly stated in writing by the student and submitted along with the research paper. Furthermore, the paper may be integrated with other work and later submitted for publication with a longer list of authors.

Research papers take many forms, and some venues require particular nomenclature or forms. The paper submitted to the faculty to meet this requirement should include the following components:

- A clear statement of the problem
- An innovative idea that addresses the problem
- A survey of the relevant research literature
- An explication and implementation of a methodology for addressing the problem
- Evidence that the described idea achieves its goal
- Analysis and evaluation
- Discussion of the research, including but not limited to shortcomings of the work and directions for future work.
- A list of references

While it is possible to deviate from this structure, this should only be done with the support of the advisor.

**An oral presentation and defense:** Submission and presentation of the paper must be made not later than in the last January of the first four terms in in the program. Students must complete 6 credits of doctoral courses and 6 credits of doctoral seminars before taking the preliminary examination. The due date for submission of the paper is the second Friday of January. On the fourth Friday of January, papers will be presented orally in conjunction with the IS Ph.D. oral presentations to graduate faculty in a public forum. Each student will give a 20-minute

long oral presentation of his/her paper to the faculty, followed by a 20-minute discussion. All presentations will be made on a single day. Faculty will meet the same day to grade the written and oral performance. The result of the exam will be: (a) pass, (b) fail with one more chance to re-take the exam the following year, or (c) fail with no chance to re-take the exam.

### **7.3.2 Timing**

A student has to pass the preliminary exam at the earliest opportunity (within the first four semesters) and should not wait till completion of coursework to attempt the preliminary exam. A student will have successfully completed the prelim exam after passing the oral presentation and defense and completion of the coursework as required.

## **7.4 Admission to Doctoral Study**

With the successful completion of the preliminary examination, the student is fully admitted to doctoral study in telecommunications. The Director of the TPC will notify the student, in writing, of admission to doctoral study.

After admission, the student must complete the remaining coursework including doctoral level seminars, minor requirements and the residency requirement.

## **8 Comprehensive Examination**

The student must satisfactorily pass a comprehensive examination designed to assess mastery of the general field of telecommunications, acquisition of both depth and breadth in the area of specialization within the field, and ability to use the research methods of the discipline. The purpose of the comprehensive examination is to assess the student's ability to understand a sub-area of telecommunications in depth. In order to do research, a student must be able to read, understand, present, and criticize research papers in the field. It is also important that the student be able to explain it in depth to someone who is unfamiliar with that area. Thus, this examination centers on the development of a tutorial as well as a lecture in which the student must explain the subject to the satisfaction of the entire Telecommunications faculty. From a learning perspective, this provides the student with the experience of structuring and explaining a technical topic in detail.

## **8.1 Eligibility**

1. Completed most of the of graduate course and seminar work for completion of a Ph.D. These credits include:
  - 6 credits in graduate level courses in a minor area. Courses related to Telecommunications are excluded;
  - 12 credits in doctoral level seminars
2. Completed a "state-of-the-art" paper to be submitted to graduate faculty two weeks prior to examination date;
3. Apply to the Director of the Telecommunications and Networking program for permission to take the comprehensive examination.

## **8.2 Registration Requirements**

Students must be registered in the term in which their comprehensive examination is taken.

## **8.3 Content and Format**

The comprehensive examination has a written component and an oral component. In preparation for the one-hour oral examination, the examinee must prepare a written "state-of-the-art" paper that must be submitted to the TPC two weeks prior to the scheduled exam date. The "state-of-the-art" paper is a critical essay that explores the literature of the selected topic; the student identifies, synthesizes, and evaluates the relevant literature on the topic. (See Appendix B.)

The comprehensive examination will be conducted by at least four members of the TPC faculty. The exam will be directed at the "state-of-the-art" paper and the various relationships among the components of telecommunications. Goals of the comprehensive examination committee are to assess the student's understanding of the topic of the "state-of-the-art" paper, the theoretical framework that supports it; the quality of the student's research skills necessary to understand, integrate, and extend knowledge gained through scholarly inquiry; and the relationships of the topic to telecommunications. The results of the exam are conveyed to the student, by the examination committee, usually within an hour after completion of the exam. The result of the comprehensive examination is a pass or fail. If a student fails, they may retake the exam one more time. A student who fails the comprehensive examination twice is no longer eligible to continue in the Ph.D. program.

## 8.4 Process

The procedure to schedule and take the comprehensive examination is as follows:

1. The student will select a topic of interest in his research area in consultation with his advisor. When the advisor is satisfied that the student understands the subject matter in sufficient depth, the student prepares a tutorial paper.
2. The student will prepare a comprehensive literature survey of the research on this topic and prepare a tutorial document that is referenced and complete in itself. This document must not exceed 20 pages in length, with a font size of 12 pt, and margins of 1 inch on the left and right. Also, the document must be prepared so that the faculty can easily read it. A researcher in Telecommunications who is not familiar with the research topic should be able to understand and appreciate the issues in this topic by reading this document.
3. The work should be completely done by the student except for informal suggestions from the advisor. The advisor may provide only grammatical feedback; it is up to the student to decide what content is necessary, and how to organize it, because this is a crucial part of the tutorial. Occasionally, the advisor may suggest inclusion of certain topics.
4. The student finds a date for the presentation where at least four of the telecommunications faculty can attend. At least two weeks prior to the examination date, the student must deliver a final copy of the tutorial document to all faculty members.
5. It is strongly recommended that the student provide some preliminary research results on an advancement in the topic or at least reproduce the most relevant work conducted by researchers in this topic.
6. The student has to publicly present the material from this document orally on the day of the examination to the faculty in a presentation lasting 45 minutes. The presentation will be tutorial in nature with additional results if any. The faculty may question the student to assess his or her understanding of the topic in question as well as in any general topic in the area. The faculty may ask questions for clarification and to test the student's grasp of the subject as well as closely related subjects and methodologies.

The response of the TPC may take on several forms, including:

- Unconditional pass
- Conditional pass, with conditions such as

- Additional recommended or required coursework
- Specific modification to the tutorial paper
- Re-attempt the oral presentation
- Fail

All Telecommunications students are encouraged to attend comprehensive exams to see what is expected and learn from the tutorial presentation.

## **8.5 Time and Timing**

The Comprehensive should be taken after the student has completed almost all coursework, seminars, etc. and after the student has successfully completed the Preliminary examination. Typically, a student will complete the comprehensive exam within 18 months of completing the preliminary exam.

# **9 Dissertation**

## **9.1 Dissertation Advisor**

Students must gain the agreement of a member of the telecommunications faculty, who is also a member of the graduate faculty, to chair the dissertation committee that will advise the student on the area of research. The advisor's agreement is recorded in the student's file. Any request to change the dissertation advisor must be submitted in writing to the chair of the TPC. Approval for the change and the selection of another dissertation advisor is filed in the student's folder.

The student's dissertation advisor:

1. Assists in choosing the dissertation committee and in confirming the eligibility of all members selected;
2. Arranges with the TPC support staff to schedule the dissertation proposal presentation;
3. Reviews progress toward completion of the research;
4. Arranges with support staff to schedule the dissertation defense;
5. Chairs the dissertation defense;
6. Secures appropriate signatures from dissertation committee members and assures that all required paperwork is submitted in accordance with the TPC, SIS, and University procedures.

## 9.2 Dissertation Proposal

After successfully completing the comprehensive examination, the student, in consultation with the dissertation advisor, must prepare a dissertation proposal and select a dissertation committee. The dissertation proposal must be approved by the dissertation advisor and the dissertation committee.

The dissertation proposal represents a contract between the student and the dissertation committee. The student should specify in as much detail as possible the problem they wish to solve and the method they intend to use to solve it. Acceptance of the proposal includes, to the extent possible, concrete research goals. When the student achieves the goals, the Ph.D. research is to be considered finished. Modification of the goals can only be made collectively and should be written and signed by the student and each committee member. The student should make regular progress reports to the entire committee. According to university policy:

Meetings of the doctoral candidate and his/her dissertation committee must occur at least annually from the time the student gains Admission to Doctoral Candidacy. During these meetings, the committee should assess the student's progress toward degree and discuss objectives for the following year and a timetable for completing degree requirements.

Students demonstrate their ability to complete a sound project of original research by presenting and defending the dissertation proposal to their dissertation committee. The dissertation committee must unanimously approve the dissertation topic and research plan before the student may be admitted to candidacy for the doctoral degree. Approval of the proposal does not imply either the acceptance of a dissertation prepared in accord with the proposal or the restriction of the dissertation to this original proposal.

Originality may be reflected in a number of ways. For example, a candidate may pose an important new problem or formulate an existing problem in a novel and useful way. A candidate may investigate previously ignored material or develop new techniques for investigating issues. Extensions of previous investigations are acceptable provided they incorporate important new elements in the design or execution of the research.

Normally, a satisfactory dissertation will form the basis for one or more publishable articles. The dissertation committee may offer an opinion on the publishable content of the proposed research.

### **9.2.1 Time and Timing**

The proposal may be done any time after the successful completion of the comprehensive examination. University rules require that the proposal be completed at least six months prior to the final defense of the dissertation. The timing of the proposal depends heavily on the student's dissertation project. The actual timing depends on the student's ability to demonstrate the project's feasibility to the committee. For some, this will occur early in the research cycle; for others, this will occur later. It is generally in the student's interest to do this earlier rather than later, since it defines the scope of the completed dissertation. In any case, every student should aim at completion of their dissertation proposal within one year of passing the comprehensive exam.

### **9.3 Dissertation Advisor**

In most cases, the student's academic advisor continues as the dissertation advisor and chair of the dissertation committee. By University regulations the dissertation advisor must be a graduate faculty member of the Telecommunications Program. In the event that either the student or advisor desires a change, another graduate faculty member from the Telecommunications Program may serve as dissertation advisor and chair of the dissertation committee.

### **9.4 Committee and Procedure**

The dissertation committee, selected by the student and major dissertation advisor, shall consist of at least five members, including the dissertation advisor, with the majority being from the telecommunications graduate faculty. One of the members must hold a primary faculty appointment outside the Telecommunications Program Committee. Upon the recommendation of the dissertation advisor, a member, or members, may be appointed from outside the University. The expenses involved in the attendance of the outside person at meetings are not the responsibility of the School.

Members of the dissertation committee are to be selected by the student in consultation with the dissertation advisor. The dissertation committee is responsible for monitoring the research, conducting and evaluating the oral defense of the dissertation, and approving the final written presentation of the dissertation. The dissertation advisor directs the dissertation research and writing, but all committee members have the responsibility to assist the student as consultants. All members of the committee may vote.

The student then schedules a presentation of the dissertation proposal, notifies the telecommunications secretary, and provides a written copy of the proposal to the committee members at least two weeks prior to the presentation date. The dissertation committee must unanimously approve the dissertation topic and research plan before the student may be admitted to candidacy for the doctoral degree. When the proposal has been successfully defended, the chair of the student's dissertation committee shall notify the Chair of the Ph.D. Committee, the director of the Telecommunications Program Committee, and the Dean of SIS that the student has achieved formal candidacy.

Written notice of the student's meeting with the dissertation committee to approve the proposal will be distributed to the TPC faculty at least one week in advance. The notice will contain the student's name, the title and abstract of the proposal, the date, time, and place of the meeting. The committee will conduct the proposal hearing and must unanimously approve the dissertation topic and the research plan. After approval, major changes may not be made without approval of the student and the dissertation committee. The student is responsible for filing a copy of the approved proposal in the Telecommunications Program office.

## **9.5 Candidacy**

For admission to formal candidacy for the Ph.D. degree, a student must have:

1. Passed the preliminary examination;
2. Completed all coursework requirements (with the possible exception of dissertation credits) with a QPA of 3.3 or higher;
3. Passed the comprehensive examination;
4. Successfully presented a dissertation proposal and received permission from the dissertation committee to begin research.

When these steps have been taken, the chair of the student's dissertation committee will notify the Chair of the Ph.D. Committee, the Director of the TPC, and the Dean of SIS that the student has achieved formal candidacy. The program Director will notify the student of his admission to doctoral candidacy in writing. A copy of the notice will be placed in the student's folder. The student is expected, at this time, to schedule and present a colloquium on his/her research in an open forum in the School of Information Sciences.

## **9.6 Dissertation Research - Procedural Requirements**

The student must submit all forms, letters, and questionnaires related to the dissertation research to the TPC members of the dissertation committee for approval before any such documents are publicly distributed.

The student is also responsible for meeting University requirements when human subjects are used in research. These requirements are found in the University of Pittsburgh's Guidelines to the Use of Human Subjects in Psychosocial Research. The School of Information Sciences has a faculty representative on the Psychosocial Institution Review Board who may be contacted with questions of procedure.

The student must prepare a final copy of the dissertation conforming to the University of Pittsburgh's Style and Form Manual for the format of the dissertation. Since the bibliographic style is best determined by the subject of the dissertation, a style manual of the student's choice may be used for the content of the dissertation and must be applied consistently throughout.

If University facilities and/or faculty time are being used in dissertation research and/or the writing of the dissertation, then students are required to register for at least 3 credits per term or such greater amount as the School or Program deems appropriate. Students who have completed all credit requirements for the Ph.D. degree and are working full time on their dissertations, should register for fixed-fee full time dissertation credits. If the student is a doctoral candidate and off-campus, not using University facilities and/or faculty time, the candidate need only register for 1 credit per academic year to maintain active enrollment status.

## **9.7 Dissertation Defense**

The purpose of the final defense is to assess the student's ability to present and defend the result(s) of their original research project. The student must be able to clearly communicate the problem, the method, the assumptions, and the results of the project. He or she must be able to clearly articulate and support all assumptions and decisions that were made toward the process of completing the project. While the student's committee makes the final decision, the defense is public and questions are accepted from any attendee.

### **9.7.1 Dissertation**

After completing the investigation and preparing the dissertation, the candidate is advised to submit the first draft to the dissertation advisor early in the term in which he/she expects to receive the degree. This allows time for any necessary revisions and for preparation of the final copies in an acceptable style and format.

Any exceptions to the style manual approved for the School must have prior approval by the advisor. Final decisions concerning style and format rest with the student's dissertation advisor. Note the dissertation can either follow the traditional book format model or a collection of published research articles. If the later case, the published work must be logically connected and integrated into the dissertation in a coherent manner, and sufficient detail must be presented to satisfy the characteristics of a dissertation. If the published articles were co-authored, the contribution of the student must be clearly delineated in the introduction so the committee can ascertain that the student's own work satisfies the requirements of a dissertation. Instructions on incorporating articles into the dissertation are provided in the Format Guidelines for Electronic Thesis and Dissertation Preparation at the University of Pittsburgh.

### **9.7.2 Eligibility for the Dissertation Defense**

To be eligible to defend the dissertation, a student must have:

1. Completed the residency requirement;
2. Requested the formal announcement of the defense in the University Times through the School;
3. Distributed copies of the dissertation to the dissertation committee at least four weeks prior to the date of the defense.

### **9.7.3 Registration Requirements**

Students completing their research work for the dissertation will be required to register for at least one credit in the term during which they expect either to complete degree requirements or have the oral defense. Students must submit an application for graduation for the term in which he or she has planned the dissertation defense. The application for graduation and the related deadlines and late fee structure are available on the [School of Information Sciences' internal website](#) on graduation procedures.

If a student does complete all the work in a given term, including the dissertation oral examination, and has been cleared for graduation too late to be included on the graduation list for that term, the student may apply to graduate the following term and need not enroll for any courses or any credits, subject to approval by the Dean's office.

If a student is unable to complete the work during the expected term of graduation due to some extenuating circumstances related to the School and University (beyond control of the student and attested to by the Dean's office), the student will

not be required to register for additional credits in the term of graduation.

All requests for exceptions to the policy stated above should be sent to the Program Director from the advisor for clearance and recommendation and then to the Dean for approval consideration.

#### **9.7.4 Defense of the Dissertation**

The dissertation defense is scheduled by the dissertation advisor early enough in the term to allow for necessary revisions and final editing of the manuscript before the graduation deadline. The candidate must submit copies of the dissertation to the dissertation advisor and to the dissertation committee at least four weeks prior to the scheduled dissertation defense. A copy must also be filed with the secretary of the TPC at least four weeks before the date of the dissertation defense meeting. Notice of the dissertation topic/title/abstract; the defense date, time, and location; and the availability of the final draft copy of the dissertation will be publically posted and notice sent to the the TPC and SIS faculty at least one week ahead of the scheduled defense.

Dissertation defenses must be publicly announced and are open to the University community, but only the dissertation committee may vote. A student defends his/her dissertation successfully if the dissertation committee unanimously approves it. Although the dissertation defense is dedicated primarily to the field of the dissertation, other questions relating to telecommunications may be considered at this time. The chair of the dissertation committee serves as the session moderator.

A student who successfully defends the dissertation with conditions to be completed must satisfy those conditions with the approval of the dissertation advisor within one year.

#### **9.8 Completion of the Dissertation**

The dissertation should be completed within the statute of limitations described below. If the statute of limitations is about to be exceeded and there is evidence of reasonable progress, the TPC may extend the statute by a specific period usually not exceeding one year. It is the student's responsibility to present evidence of progress to his/her advisor along with a request for extension prior to the end of the statute of limitation period. All requests for extension must be approved by the TPC.

#### **9.9 Publication of the Dissertation**

All candidates for a Ph.D. degree are required to submit their official dissertations electronically using the University of Pittsburgh's procedures for Electronic Theses and Dissertations (ETD). In that case, the candidate is required to pay a fee specified by the University to Student Accounts and submit various items as outlined on the School of Information Sciences' PhD Graduation

Checklist.

The abstract must not be more than 350 words (2450 typewritten characters) in length. With 70 characters per line there are at most 35 lines in the abstract. All copies of the abstract must be approved [and initialed] by the dissertation advisor [in the upper right-hand corner of the abstract]. The dissertation and abstract will be examined and approved by the student's dissertation advisor for style, format, and related matters.

Any dissertation may be published after the final defense provided that the dissertation submitted for publication is approved as to form and content by the dissertation advisor and also provided that due acknowledgement is made to the University. No form of publication, however, shall relieve the student of the responsibility for following the University's Electronic Theses and Dissertations (ETD) formatting and submission guidelines as outlined on the School of Information Sciences' PhD Graduation Checklist.

For ETD formatting guidelines and general information, please visit the [University of Pittsburgh Electronic Theses and Dissertations website](#). For deadlines and contact information regarding the School of Information Sciences' required graduation and ETD paperwork, please visit the [School of Information Sciences' internal website on graduation procedures](#).

### **9.10 Journal Requirement**

All Ph.D. students are required to submit an article of publishable quality (based on their dissertation) to a journal before the degree is awarded. This shall be noted when applying for graduation with signatures of the student and the advisor.

## **10 Statute of Limitations**

University policy requires all graduate degrees to be completed in a timely manner.

The purpose of the statute of limitations is to ensure that a graduate degree from the University of Pittsburgh represents mastery of current knowledge in the field of study.

All requirements for the Ph.D. degree must be completed in not more than six calendar years from the time of first registration. Students may, in extenuating circumstances, submit a formal request for extension of their statute of limitations or for a leave of absence from the program. The request must be submitted to the advisor and then presented to the TPC. In all other matters of policy, refer to the University publication, Regulations Governing Graduate Study at the University of Pittsburgh, 2008.

## **Appendix A: Registration Requirements for International Students**

In accordance with University policy, all international graduate students are required to be registered for a full course of study which is 9 credits per term for two consecutive terms. (The third term may be for fewer credits.) After completion of all required coursework, all international students must be registered for at least 1 credit per term until completion of their degree in order to maintain active status. Such regulations may change as determined by the University of Pittsburgh's Office of International Services.

New international students MAY NOT BE REGISTERED until they have taken the required TOEFL or Michigan test, administered by the English Language Institute in cooperation with the Office of International Services (OIS), and the results are available and have been reviewed by the program advisor.

New international students must take their signed registration documents to OIS for verification before submission to the Registrar's Office. Passports should be presented to OIS at this time. Other requirements (that may change) as specified by the OIS are mandatory.

## **Appendix B: Questions to Consider in Selecting a Dissertation Advisor**

Before starting dissertation research, you must have a major advisor who agrees to supervise your work. In addition, you and your advisor will select members for your dissertation committee. You must successfully defend your proposal (at which time you are admitted to candidacy). You and your advisor must mutually agree on the advising agreement and the research topic. Both of you should enter the relationship as well informed as possible about the other. In advising relationships, "divorces" are possible, but they upset the timely progress toward a degree and are emotionally draining.

Trade-offs and compromises are to be expected in selecting an advisor. For instance, it might be preferable to choose an advisor whose students take a slightly longer time to complete their degrees if they usually gain better jobs than those of a different faculty member. While some students may be eager to work with a famous professor, others might fear that the busiest advisors would have the least time for their students. Finally, be aware that procedures for matching students and advisors may vary by program or department.

To select the best advisor, you might meet with all the faculty members of your program and talk with other graduate students in the program about the qualities

of the faculty members eligible to direct dissertations. Be cautious about making assumptions, and ask questions covering a range of topics. Some points should best be discussed with the faculty member in question, others might better be asked of advanced graduate students. To help you, here is a list of questions you might ask in selecting a dissertation advisor; it is not intended as a list of mandatory qualities that advisors should possess. Some items may pertain to other disciplines. Remember, too, that faculty members will have a number of questions for you.

1. Is the advisor an expert in the area of research or scholarship that you intend to pursue? Is his/her critical or theoretical orientation consistent with yours?
2. How much freedom will you have in your choice of dissertation topic with this advisor?
3. What is the reputation of the advisor within the discipline?
4. How responsive is the advisor? How long does it take him/her to return written material with comments?
5. How accessible is the advisor for discussion?
6. Is the advisor likely to remain on the faculty for the duration of your degree work?
7. How many students does he/she advise? If none, why? If a large number, does this affect the attention that he/she pays to individual students?
8. How much time does he/she spend away from campus? Is he/she available during the summer?
9. How long do students take to complete their degrees with this advisor?
10. What proportion of this advisor's students successfully complete the program?
11. What is the placement record of this advisor's students? Where do they get jobs?
12. Does the advisor publish with his/her students as first author?
13. How many publications does the typical student accumulate with this advisor?
14. Do the advisor's students go to disciplinary or professional conferences?

15. Do the advisor's students make presentations of their own work at conferences? Do they make presentations of joint work with the advisor?
16. How much interaction is there with other advisees of this faculty member? Does he/she direct a research group or rather a series of individuals?
17. How much of the research is collaborative with the advisor and/or other advisees?
18. How much involvement is expected in "group" research projects that are not appropriate for inclusion in your dissertation? How much of this contributes to your professional development and marketability?
19. How is credit for collaborative work assigned?
20. Is the advisor engaged in patentable or saleable work? If so, how does he/she assign credit to the student? Does this work get published promptly?
21. Is the advisor's work funded? What are the guarantees of funding for the advisor's students? Do the advisor's students get summer support?
22. Does the advisor assist his/her students in obtaining their own funding from outside sources such as fellowship programs?
23. Does the advisor have good relations with other faculty in the program?
24. Does the advisor have a reputation for ethical behavior?
25. Are the advisor's work habits compatible with your own?

## **Appendix C: Summary of Steps Leading to the Ph.D. Degree in Information Science/Telecommunications**

Responsibility: Party having responsibility is underlined.

### Student

1. Submits an application and supporting documents for admission to graduate study in telecommunications to the University of Pittsburgh using the online application procedure.

### Admissions Office

2. Notifies the student of admission in writing/email.

Faculty Advisor and Student

3. A graduate faculty member is assigned to serve as the student's program advisor. A plan of study is jointly prepared by the student and faculty advisor. A copy of the plan of study is filed in the student's folder. The student registers with the advice and consent of his/her program advisor for at least one term each academic year.

Student

4. Prepares for the preliminary examination which must be taken within two calendar years of matriculation. Prepares a request for admission to the preliminary examination after consultation with the program advisor. Sends request to the secretary of the TPC.

Ph.D. Czar of the Telecommunications Program

5. Admits the student to doctoral study after he/she successfully completes the preliminary examination. A copy of the letter notifying the student is placed in the student's folder.

Student

6. Completes at least 12 credits of doctoral seminars; completes the 6-credit minor requirement (not including courses related to Telecommunications); and completes the residence requirement which is three terms of full-time study, 9 or more credits in the Fall, Spring or Summer terms (sum of Summer Session I and Summer Session II must be 9 credits or more); two of these terms must be consecutive and must be taken after successful completion of the preliminary examination.

Advisor and Student

7. The program advisor verifies that the student has completed all requirements listed in Step 6. The student applies to the Chair of the TPC for permission to take the comprehensive examination.

Student

8. Prepares a "state-of-the-art" paper and research plan. These must be submitted to the TPC two weeks prior to the scheduled oral examination date. After successful completion of the comprehensive examination, the student selects a dissertation advisor in consultation with the program advisor.

Advisor and Student

9. Prepare a plan for the dissertation research and revise the basic program of studies, if necessary.

Student

10. Prepares a dissertation proposal with the guidance of the dissertation advisor.

Student and Dissertation Advisor

11. Selects a dissertation committee.

Student and Dissertation Committee

12. Meet together for formal approval of dissertation topic. The proposal must be submitted to the dissertation committee two weeks prior to the scheduled meeting date.

Student

13. Responsible for filing a copy of the approved proposal with the secretary of the Ph.D. Committee.

Advisor

14. Recommends to the Department Chair that the student be admitted to doctoral candidacy following the approval of the dissertation topic.

Ph.D. Czar of the Telecommunications Program

15. Sends a written notice of doctoral candidacy to the student and to the student's folder. Also initiates status change on the University transcript.

Student

16. Registers for dissertation credits and pursues the dissertation research. Is expected to schedule and present a colloquium on his/her research in a public SIS seminar series.

Student

17. Prepares his/her dissertation. A copy of the dissertation must be made available to the dissertation committee at least four weeks prior to the scheduled defense date. In addition, one copy of the dissertation is to be given to the secretary of the TPC for accessibility by interested faculty at least four weeks prior to the scheduled defense date.

Dissertation Advisor

18. Schedules the final oral examination and notifies the dissertation committee (at least four weeks ahead of time) and the TPC and SIS faculty (at least one week ahead of time) of the topic, date, place, and time of the examination. Publishes University-wide announcement in the University Times.

Student and Dissertation Committee

19. The student defends his/her dissertation. Formal approval by the dissertation committee is required.

Student

20. Submits one copy of the approved dissertation and abstract to the dean's office. Completes the Microfilm Agreement and the Survey of Earned Doctorate.

Student and Advisor

21. Verifies the submission of at least one article to a journal.

Advisor

22. Verifies that the above documents are correct and of a quality to reflect the highest standard of the School and the University of Pittsburgh.

Student

23. Applies for graduation. Application for graduation and payment of associated fees must be filed before the deadlines posted by the university in the yearly academic calendar.

School

24. Confers the degree at the University commencement. Graduation occurs at end of each term, but there is only one commencement usually held the last Sunday in April.