

# Doctoral Student Handbook

*Program in*

## Computer Science and Informatics

*Concentration Streams*

**Computer Science  
Software and Information Technology**

Department of Computer Science and Engineering  
School of Engineering and Computer Science  
Oakland University

2008–2009

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# 1 General

The Doctoral program in Computer Science and Informatics at Oakland University admits students both for part-time and full-time study. The entire program must be completed in seven (7) calendar years regardless of whether the student is full-time, part-time or is full-time for a portion of their program.

The department offers two streams of specialization within the Computer Science and Informatics program.

- Computer Science
- Software and Information Technology

The *Computer Science* stream is designed for students intending to pursue research in the core areas of computer science with a theoretical focus. The *Software and Information Technology* stream is designed for students intending to pursue research in the applied areas of interdisciplinary computing and information technology.

The program is designed for students with academic backgrounds in Computer Science, Software Engineering, Computer Engineering, and Information Technology. Applicants are eligible to apply after a Bachelor's or a Master's degrees in these disciplines. Applicants with academic degrees in other disciplines and wishing to pursue interdisciplinary research may pursue the Software and Information Technology stream after gaining proficiency by completing supplemental course work.

Applicants who received their undergraduate degree from an institution outside of North America are strongly encouraged to submit scores from the Graduate Record Examination.

## 1.1 Roadmap

A student entering the program must demonstrate proficiency in foundation coursework described in Section 3.1). Detailed degree requirements are discussed in Section 2. A doctoral student will complete the following:

- *Research Seminar* – 2 credit hours
- *Research Initiation* – 2 credit hours
- *Math Course:* Choose from list provided in Section 3.2 – 4 credit hours
- *Electives:* Graduate courses – 16 credit hours if entering the program after a Master’s degree, or 48 credit hours if joining after undergraduate degree.
- *Dissertation Research* – 24 credit hours

Students must complete their Program of Study. This form is included in the Appendix.

## 2 Degree Requirements

Upon admission to the Ph.D. program in the Computer Science and Informatics, the students gain the status of Ph.D. applicant. As illustrated in Table 3, their status changes to a Ph.D. candidate after they have successfully passed their qualifying examinations.

It is recommended that doctoral students form an advisory committee within the first two regular semesters<sup>1</sup> of becoming a Ph.D. applicant.

Two specialization streams are offered.

- Computer Science
- Software and Information Technology

The *Computer Science* stream is meant for students desiring to perform research in the core areas of computer science, while the *Software and Information Technology* stream is meant for students desiring to conduct research in the applied areas of interdisciplinary computing and information technology.

### 2.1 Advisory Committee

The committee will be comprised of three advisors, and a member appointment by the Dean of the School of Engineering and Computer Science. The composition of the committee members chosen by the doctoral student is governed by the student's chosen stream of specialization.

A doctoral student choosing the *Computer Science* stream is required to include a faculty from the department of Mathematics as a member of their committee.

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<sup>1</sup>A regular semester is defined to be the Fall or Winter semester.

A doctoral student choosing the *Software and Information Technology* stream is not required to include a faculty from the department of Mathematics; however, their committee must include the faculty from the area that their research is most applicable to. For example, a student researching in bioinformatics will include a faculty from the department of biological sciences, a student studying computational models for quantum mechanics will include a faculty from physics, and a student developing multimedia for gaming will include a member from fine arts in their committee.

While it is recommended that the candidate's advisory committee be formed early, so that the doctoral student may develop their coursework with their consultation, in no event will the doctoral student be allowed to appear for their Option and Oral qualifying examinations without having first formed their advisory committee.

Other significant programmatic requirements for obtaining a doctoral degree in Computer Science and Informatics are noted below:

- For students holding a M.S. degree: A minimum of 48 credit hours of graduate courses is required for the degree, including the 24 credit hours of dissertation research. For students holding a Bachelor's degree: A minimum of 80 credit hours of graduate courses are required for the degree, including the 24 credit hours of dissertation research.
- **Core qualifying examination:** Students must pass the core examination within the *first four regular semesters* of admission into the Ph.D. program. Each doctoral student will have two attempts to pass this examination.
- **Option qualifying examination:** Students must pass **two Option** qualifying examinations pertinent to their stream. These are depth examination designed to test the applicant's preparation in the subject areas most pertinent to their research. The option examinations are administered by the doctoral student's advisory committee. Hence, the

doctoral committee must be appointed before a student may appear for an *Option* examinations.

- All Ph.D. applicants must pass an **Oral Examination** also administered by doctoral student's advisory committee.
- All qualifying examinations, namely, the core examination, the two option (depth) examinations, and the oral examination, must be completed within eight regular semesters of joining the program. Upon successful completion of the qualifying examinations the student status is changed from a *Ph.D. Applicant* to a *Ph.D. Candidate*.
- All doctoral students are required to complete a 2-credit hour Research Seminar course, and a 2-credit hour Research Initiation course.
- All doctoral students are required to complete a 4-credit hour course in Mathematics. A list of approved courses to choose from is provided in Section 3.1. An alternate course may be chosen with approval of the doctoral committee.
- All doctoral students must demonstrate some experience in teaching. The supervising faculty or departmental chairman and the faculty in-charge for the Research Seminar course will certify to the completion of teaching experience requirement.
- The entire program must be completed within a period of seven calendar years.

## 3 Coursework Requirements

### 3.1 Foundation Coursework

Students joining the doctoral program are expected to be prepared in the foundations of Computer Science and Mathematics. Some of the pertinent courses

providing an evidence of such a preparation include coursework in Discrete Mathematics, Data Structures, Programming Languages, Algorithms, and Theory of Computation. A student lacking in necessary preparation in foundation courses must complete them at the earliest possible opportunity. These pre-requisite courses will be typically noted as a condition for the admission to the doctoral program.

### 3.2 Advanced Mathematics Course

Additionally, doctoral students will be required to complete **one** of the following courses (the **Math Course** in the program of study):

- APM 533: Numerical Methods
- APM 534: Applied Numerical Methods
- APM 569: Graph Theory and Applications
- STA 521: Multivariate Statistical Methods I
- STA 527: Linear Statistical Models
- STA 530: Time Series
- MTH 651: Functional Analysis

### 3.3 Electives

Assuming that the doctoral student has completed their foundation coursework as a part of their 32-credit hours Master's degree, they will need to complete 24 credit hours of additional coursework to meet the total coursework requirements for the doctoral degree. If the student takes a four (4) credit hours for the Math course and four (4) credit hours of required research

courses (Research Seminar + Research Initiation worth two (2) credit hours each), there will typically be 16 credit hours remaining for elective courses.

Students are strongly advised to consult their advisor and/or the committee in choosing these electives.

## 4 Qualifying Process for Ph.D. Candidacy

The applicant must pass the *Core* qualifying examination in Computer Sciences and Informatics. In addition to passing the common *Core* examination, the applicant must pass *two Option* qualifying examinations pertinent to their stream, and an *Oral* examination. Student must have their doctoral committee established before appearing for the *Option* and *Oral* Examinations, and should elect the examination subject areas in consultation with the advisory committee.

### 4.1 Core Examination

The core examination must be completed by all Ph.D. applicants irrespective of the chosen stream of specialization. The exam comprises of 80 multiple choice questions from subject areas listed in Table 4. Doctoral students failing to pass this examination within two attempts will be dismissed from the program. The **Core** examination is administered by the department during Fall and Winter semesters. Students planning to take the qualifying examination must inform the department of their intent one semester prior to their anticipated date for taking the core qualifying examination.

### 4.2 Option (Depth) Examinations

Based on the stream selected by the Ph.D. applicant, two in-depth *Option* examinations areas must be chosen in consultation with the applicant's advisory committee. These examinations are administered by the doctoral committee. Following is a *representative* list of subjects typically tested in each of the two streams. This is only meant as a representative list. *The subjects your committee chooses to test a doctoral student on is not limited to the areas listed below.*

- **COMPUTER SCIENCE**

Applicants must select any two examinations from the following subjects:

1. Formal Methods and Theoretical Computer Science
2. Software Engineering
3. Database Management Systems
4. Computer Networking and Communications
5. Knowledge Engineering

- **SOFTWARE AND INFORMATION TECHNOLOGY**

Applicants must select any two examinations from the following subjects:

1. Object Oriented Analysis and Design
2. Information Storage and Retrieval
3. Bioinformatics
4. Wireless Systems
5. Multimedia and Visual Computing

### **4.3 Oral Qualifying examination**

Within one semester of successfully completing the written qualifying examination, the Ph.D. applicant will present a brief summary of their proposed research to a committee appointed by the department. The purpose of the Oral Qualifying Examination is to evaluate the applicant's knowledge of research in their chosen area as well as on research techniques and an awareness of research ethics.

## 5 Teaching Experience Requirement

The Department of Computer Science and Engineering at Oakland University considers that relevant teaching experience in computer science and engineering is an integral part of a candidate's career. Successful computer scientist, even in non-academic careers, are often called upon to make presentations and train their proteges in order to make appropriate advancements in research. Further, they are also called upon to disseminate information on technologies facilitate technological transfers where and pedagogical skills are generally an asset.

Accordingly, unless waived due to candidate's prior teaching experience, our Ph.D. program requires students to teach a course for one term. This may be accomplished concurrently with the Research Seminar course. By enabling them to serve as instructors, the seminar course is designed to provide them with this experience. The goal of this teaching requirement is to ensure that all graduates of our Ph.D. program are proven teachers and have experienced the group dynamics of teaching and are comfortable in leading classroom discussions. The students are encouraged to avail the opportunities to direct undergraduate students on problem solving strategies, particularly within the context of senior projects.

## 6 Dissertation Research Progress and Defense

A Ph.D. candidate should meet with members of her/his Advisory Committee at least once each academic year for an update on research progress. There are two requirements prior to the PhD public defense: 1) The doctoral dissertation; 2) Two published or accepted journal or conference papers. The dissertation must be presented to members of the Advisory Committee at least two weeks before the date of the doctoral defense. The publications should be peer-reviewed in competitive indexed journals or conference proceedings. The recommended conferences are those organized by entities such as ACM, IEEE, SPIE. The latter requirement should be met at the time the defense date is being arranged. The defense is the final step where a Ph.D. candidate presents her or his research results to the advisory Committee and the scholarly community at large. Attendance to the defense is open and should be publicly announced. There is usually a period at the end set aside for questions by public audiences as well as private questions by advising committee. All formalities will be taken care of by the office of Associate Dean of School of Engineering and Computer Science.

## 7 Graduate Faculty – Research Interests

**Debatosh Debnath:** Computer-Aided Design Tools for Logic Circuits; Field Programmable Gate Arrays; Microprocessor-Based Systems.

**Huirong Fu:** Information Assurance & Security; Wireless & Mobile Networks; Sensor Networks; Networks/Protocols/Applications; Internet Data Center, Multimedia Communication Systems; Resource Management and Quality of Service; Audio and Video Processing & Transmission.

**Dae-Kyoo Kim:** Software Design and Specification; Pattern-Based Development; Aspect-Oriented Design; Component-Based Development; Access Control Policies.

**Lunjin Lu:** Program Languages; Program Analysis and Manipulation; Logic and Constraint Programming; Program Debugging; Program Environment.

**Fatma Mili:** Database Systems; Design Support Systems; Formal Methods; Program Verification; Software Engineering.

**Nilesh Patel:** Multimedia Processing; Software Engineering; Mobile Computing.

**Guangzhi (Mark) Qu:** Network Security; Operating Systems; Adaptive Learning; Data Mining.

**Ishwar Sethi:** Data Mining; Image and Video Processing; Multimedia Information Retrieval; Pattern Recognition; Object Recognition and Tracking.

**Mohammad Siadat:** Medical Image Processing; Multimedia; Graphics and Animation.

**Gautam Singh:** Machine Learning and Artificial Intelligence; Biological and Legal Informatics; Educational Technologies; Information Fusion; Evolutionary Algorithms; Software Design.

**Chingseh (Mike) Wu:** Software Engineering; Software Process Improvement; Tactical Software Systems; Distributed Process Control Systems; System Analysis & Design; Database Systems; Data Mining.

## 8 Appendix

**Ph. D. Program of Study**  
**Computer Science and Informatics**  
**Department of Computer Science and Engineering**  
**School of Engineering and Computer Science, Oakland University, Rochester, MI**

Student Name: \_\_\_\_\_ Student No: G00  
 Term of Admission to Program: \_\_\_\_\_  
 Area of Interest: \_\_\_\_\_ Ph.D Degree: Comp. Sci. / Soft. & Info. Tech. (please circle)

Advisory Committee: Chair \_\_\_\_\_  
 (Date Approved:) Member \_\_\_\_\_  
 Member \_\_\_\_\_  
 Appointed Member \_\_\_\_\_  
 Optional Member \_\_\_\_\_

Ph.D. Coursework (Minimum 56 credits beyond Bachelors Degree)					
Course No.	Course Title	Semester	School	Credits	Grade
1.	Math Course: _____			4	
2.	Research Initiation		Oakland	2	
3.	Research Seminar		Oakland	2	
Foundation Courses (Typically - 32 credits hours of 500+-level courses)					
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
Electives (Typically - 16 credits hours of 500+-level approved graduate courses)					
1.					
2.					
3.					
4.					
5.					
Additional Courses					
1.					
2.					
3.					
4.					

Table 1: Program of Study. Ph.D. in Computer Science and Informatics..



Table 3: Progression through the doctoral program.

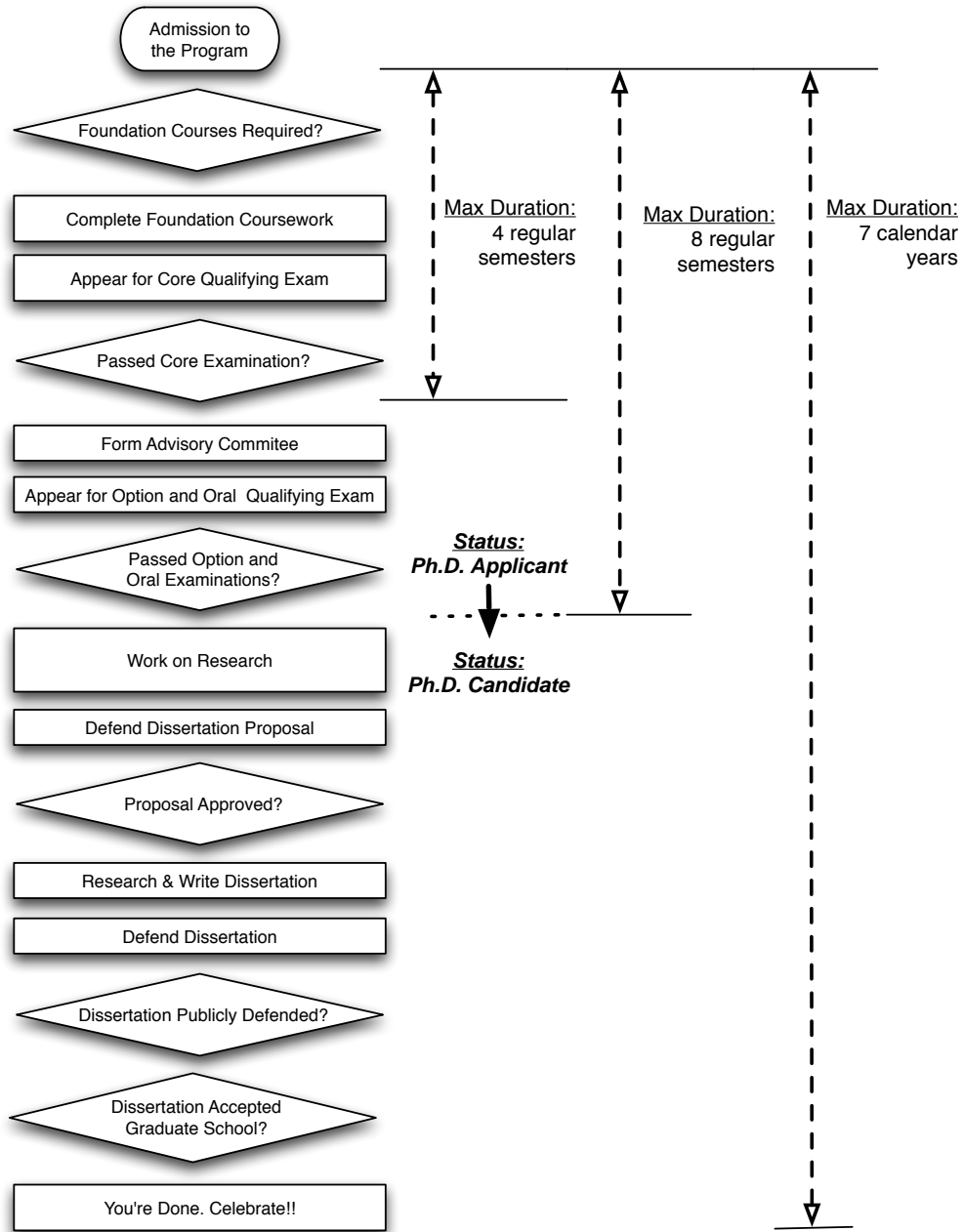


Table 4: Core Examination Subject Areas.

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1. Programming Languages
  - \* Automaton
  - \* BNF/Syntax Analyzers
  - \* Parsers
  - \* Grammars
  - \* Semantics and Major Programming Paradigms
2. Operating Systems
  - \* File Systems including indexed files
  - \* Memory Management
  - \* Process Management
  - \* Multitasking
3. Discrete Mathematics
  - \* Combinatorics
  - \* Recurrence Relations
  - \* Graph Theory
  - \* Network Flow
4. Algorithms
  - \* Algorithm Complexity
  - \* Searching & Sorting
  - \* Tree and Graph Traversals
  - \* Greedy Algorithms and Dynamic Programming
  - \* NP Hard Problems
5. Data structures
  - \* Arrays, Lists and Hashes
  - \* Trees, including AVL balancing
  - \* Heaps
  - \* Graph Structures
6. Computer Architecture & Digital Logic
  - \* Logic Gates, Circuit Minimization
  - \* State transitions and sequential circuits
  - \* Memory systems including cache memories
  - \* von Neumann, SIMD and MIMD architectures
7. Software Design and Implementation.  
(All code samples will be in Java or C.)
  - \* Conditional, Looping Statements
  - \* Static variables
  - \* Program stack and recursive procedures
  - \* Sequential Files and Buffered Streams