# Regulations for the Software Engineering Ph.D. Program <sup>*</sup>

Department of Computing and Software
McMaster University

**CAS-2019-03**

## 1   Introduction

This program is intended for students who wish to teach and/or perform advanced research and development in the field of Software Engineering. Students must:

1. satisfy the admission requirements to enter the Ph.D. program
2. successfully complete course requirements,
3. pass the Comprehensive Examination to demonstrate breadth of knowledge,
4. write and defend a detailed thesis proposal,
5. write and successfully defend a Ph.D. thesis,
6. satisfy the timeline requirements

The program is administered by the Department of Computing and Software, and the Department must appoint a

7. Supervisor and Supervisory Committee to help guide the student through the program.

There are two tracks in the program, namely, the regular track and the accelerated direct-entry track with different admission criterions, course requirements and typical program length.

## 2   Admissions

### 2.1   New admissions for the regular track

Students can be admitted to the Ph.D. program in Software Engineering if they have earned the equivalent of an M.Eng. or M.A.Sc. in Software Engineering from a reputable institution.

**(i)** An average of at least a B+ is required, or permission of the Chair.

**(ii)** Outstanding students with a Masters degree from other fields such as Computer Science, Engineering, or Mathematics and substantial Software Engineering background may be admitted to the program.

**(iii)** Admissions are on a competitive basis.

### 2.2   New admissions for the accelerated direct-entry track

Students with a Bachelor's degree in Computer Science, Software Engr. or closely related fields with good academic standing can be directly admitted to the full-time Ph.D. program. To be eligible,

1. English requirements for non-native speakers are TOEFEL $\geq 100$ (out of 120) with writing score $\geq 25$ (out of 30) or IELTS $\geq 7.5$ with writing score $\geq 7.5$ (out of 9);

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<sup>*</sup>Applicable to students admitted on or after Sept. 2019.

2. Core course GPA $\geq 10$ (out of 12) computed from 3 Calculus Courses, Linear Algebra, Discrete Mathematics, Data Structures & Algorithms Statistics/Probabilities, Operating Systems/Concurrent Systems, Software Design, Software Requirements, Introduction to Programming, and Control Theory; and

3. Research experiences at undergraduate level are highly valued.

## 2.3 Transfer from the Department's Master's programs

Advanced students in the Software Engineering M.Eng. or M.A.Sc. programs or in the Computer Science M.Sc. program may be admitted to the Software Engineering Ph.D. program without completing the Master's program if the candidate has:

**(i)** completed the course requirements of the program with an average of at least A-,

**(ii)** shown significant progress and maturity in research,

**(iii)** the full support of the supervisor,

**(iv)** the approval of the admission authority of the Ph.D. program

**(v)** the approval of the School of Graduate Studies

To request a transfer:

**(i)** a student wishing to transfer from a Masters program to the PhD program must prepare a transfer request that contains four sections:

    **(a)** a status report including transcript of courses taken and grades earned,

    **(b)** a description of the research or project carried out in the present program,

    **(c)** an application for the new program,

    **(d)** a statement by the supervisor indicating why he/she supports the transfer.

**(ii)** The transfer request is considered by the same committee that processes other requests for admission to the Ph.D. program. If the committee approves the transfer, it sends the application to the School of Graduate Studies in the usual way.

**(iii)** A transferring student must complete four courses beyond the Master's requirements, see Section 4.

# 3 The Supervisory Committee

A supervisor will be assigned to all students to guide them through the program. Two faculty members may jointly act as the supervisor. In addition, each student will be assigned a Supervisory Committee that will review and assess the student's progress.

1. The supervisors will normally be faculty members who have agreed to provide financial support and are experts in the student's intended area of research.

2. Students with financial support from government, international agencies, or other reliable sources can be admitted without a permanent supervisor. A temporary supervisor will be named for such cases and a permanent supervisor found as soon as possible.

3. The Supervisory Committee consists of the supervisor(s) and at least two additional faculty members:

    **(i)** at least one of the additional members must be from CAS

    **(ii)** one member might be from another McMaster department

    **(iii)** with permission of the Dean of School of Graduate Studies, one member might come from outside of McMaster.

4. The student and the supervisor nominate the committee. The committee is appointed by the Chair or delegate.

5. The supervisor is the chair of the Supervisory Committee and is responsible for ensuring that the committee meets as required.

6. Any external member(s) must be experts in the student's area of research.

7. The Supervisory Committee meets at least once a year to monitor the student's grades and progress in research. The meeting may be a tele-conference.

8. The Supervisory Committee will meet at least six months prior to the first attempt at the Part I Comprehensive Examination, in order to assess the state of the candidate's preparations.

9. The Supervisory Committee exercises all the duties specified in the University Graduate Calendar.

# 4  Course Requirements

Graduate courses in the Dept. of Computing and Software are grouped in three categories, i) Theory of computation and mathematics of computing (**Theory**), ii) Software and its engineering (**Software**), and iii) Computer systems and applications (**Systems**). Categorization of existing courses can be found in Appendix A.

## 4.1  Regular track

All students must successfully complete the equivalent of four one-term graduate courses[1] in Software Engineering, Computer Science, or relevant areas such as Electrical and Computer Engineering or Mathematics. Among the four required courses,

1. Two (2) Software courses

2. At least one (1) course from a non-Software category

3. At most one (1) graduate course from outside the department subject to the approval of the student's supervisor and the graduate advisor

4. At most one (1) 600-level course

5. If requested by the Admission Authority (for candidates not fulfilling all the prescribed requirements for admission), or if the Supervisor identifies a deficiency, a student may be required to take additional courses, usually PUCs[2], to supplement their education.

   In such cases the number of additional courses should normally be at most two, in some very exceptional cases at most four. A PUC may be replaced, when appropriate, by a PGC[3].

6. The student, with the agreement of the supervisor, proposes the course selection; the Chair or delegate must approve the selections. Necessary changes must be proposed and approved in the same way.

## 4.2  Accelerated direct-entry track

All students must successfully complete the equivalent of six one-term graduate courses in Software Engineering, Computer Science, or relevant areas such as Electrical and Computer Engineering or Mathematics. Among the six required courses,

1. At least two (2) Software courses

2. At least one (1) Theory course

3. At least one (1) System course

4. At most two (2) 600-level courses

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[1] A "one-term course" is a "half course" in the official McMaster terminology.

[2] A PUC is a *Prescribed Undergraduate Course* that is required as part of a student's degree.

[3] A PGC is a *Prescribed Graduate Course* that is required as part of a student's degree. A PGC may be a prescribed course that either is included among or is additional to the normal number of required courses.

5. Two free choices deemed relevant to the degree program and research, which can be from other departments subject to the approval of the supervisor and the graduate chair.

# 5   Milestones

**Departmental seminar attendance**   Full-time students are required to attend minimum 4 times or 50% per academic year, whichever is lower during the first two years of the program.

**Technical presentation**   Students are required to participate the graduate poster & demo competition *once* in the first two years of the program.

**Supervisory meeting**   Supervisory meetings must be scheduled once a year. Students should submit a supervisory report online at least 1-week before supervisory meetings (except during the years for thesis proposal and dissertation in lieu of supervisory meetings per SGS policies). Suggested content for the supervisory report can be found in Table 1 (assuming a typical duration of 4 years). Note this is a guideline and is not enforced.

Table 1: Suggested Content for Annual Supervisory Reports

| Year | Student Report | Supervisor and Committee Feedback |
|---|---|---|
| 1 | a. Statement of research topics <br> b. Literature review (and gap analysis if applicable) | a. Progress in the program <br> b. Comments on writing <br> c. Technical suggestions |
| 2 | a. Problem statement <br> b. Updated literature review and gap analysis <br> c. Research methodologies/approaches <br> d. Research plan and timeline <br> e. Preliminary results if applicable | a. Progress in the program <br> b. Comments on writing <br> c. Technical suggestions |
| 3 | a. Progress summary <br> b. Any revision/update to i) problem statement, ii) research methodologies/approaches, iii) research plan and timeline <br> c. Reflection on what works and what does not and why? Plan to move forward | a. Progress in the program <br> b. Comments on writing <br> c. Technical suggestions |
| 4 | A minimum of three weeks are expected between the student submitting his or her dissertation draft, receiving feedback from the committee and addressing any major concerns. <br><br> Between Week 2 - 7 after the submission of dissertation drafts, students are to give a public seminar on their thesis. | a. Progress in the program <br> b. Comments on writing <br> c. Technical suggestions |

# 6    Comprehensive Examination

## 6.1    Part I

The Comprehensive Examination consists of two parts. In Part I, Ph.D. candidates must demonstrate "graduate level" understanding of the undergraduate software engineering material. There is a separate document describing the examination.

## 6.2    Part II - Thesis Proposal

At the start of the thesis research, each student must submit a research proposal to the Supervisory Committee and defend that proposal. The proposal should identify an open question about Software Engineering such that answering that question is a significant research contribution and that an answer could lead to improvements in software development.

   a. The proposal should include:
       **(i)** an introduction to the question,
       **(ii)** an explanation about why an answer to the question would be important,
       **(iii)** the reasons to believe that there is an answer to the question,
       **(iv)** how the research will demonstrate the applicability of the results in Software Engineering,
       **(v)** a schedule expressed in terms of clearly defined milestones and deadlines.
   b. The defense is open to the general public.
   c. At the defense, the Supervisory Committee members should confirm that the student has
       **(i)** familiarity with the industrial solutions or approaches to the problem
       **(ii)** a good understanding of earlier research that is relevant to the problem
       **(iii)** the appropriate theoretical background that might be useful in solving the problem.
   d. The proposal should be submitted to the Supervisory Committee two weeks before the defense.
   e. The Supervisory Committee may reject the proposal in which case a revised proposal must be submitted and defended.

# 7    Ph.D. Thesis and Defense

The thesis presents the results of the student's research. The defense provides the final opportunity for evaluation of the student's work.

   a. It is the student's responsibility to present a complete thesis to the supervisor when the work is finished. The supervisor and student may jointly decide to discuss the work in smaller units.
   b. The supervisor must evaluate the thesis and specify any necessary improvements. The supervisor may reject the thesis without detailed comments if the English is not correct or understandable. It is the student's responsibility to provide a well-written thesis.
   c. The supervisor is responsible for determining that the thesis is at an appropriate level, and that it meets the standards of the program.
   d. After the supervisor is satisfied with the thesis, it will be evaluated by the Supervisory Committee. In the event of a disagreement between the supervisor and the Supervisory Committee about the acceptability of the thesis, the Chair may ask other faculty members for opinions. If necessary the Chair may appoint a new Supervisory Committee.
   e. After the Supervisory Committee is satisfied with the thesis, the student may submit it to the graduate school.

f. The Ph.D. Thesis defense will be conducted by the School of Graduate Studies following its usual procedures.

# 8 Timeline

## 8.1 Full-Time Students

This section describes the expected rate of progress through the program.

a. The supervisor is normally named when the student enters the program.
b. The Supervisory Committee is appointed as soon as possible, and not later than four months after the student enters the program.
c. The four courses should be completed within 12 months after starting the program.
d. The Comprehensive Examination should be completed within 24 months after starting the program.
e. The supervisor must evaluate the thesis within two months after the student submits it.
f. The thesis should be defended no later than four years for the regular track and five years for the accelerated direct-entry track after entering the program.

## 8.2 Part-Time Students

a. The Supervisor is named when the student enters the program.
b. As soon as possible, and in any case not later than four months following the student's arrival, the Supervisory Committee is appointed by the Department Chair or delegate.
c. Students should normally take at least two one-term courses in each of the first two academic years.
d. The required four graduate courses should be successfully completed within 24 months after starting the program. When PUCs are required, the time window might stretch until 28 months.
e. The Comprehensive Examination, both Part I and Part II, must be completed no later than 36 months after the arrival of the student.
f. Each of the two parts of Part I of the Comprehensive Examination should be taken for the first time no later than 20 months after the arrival of the student.
g. The thesis should normally be completed and defended within six years after the student enters the program.

# A Categorization of Graduate Courses

Graduate courses in the Dept. of Computing and Software are grouped in three categories, Theory of computation and mathematics of computing (**Theory**), Software and its engineering (**Software**), Computer systems and applications (**Systems**). The rationale of the categorization is to train well-rounded graduate students in Computer Science and Software Engineering with sufficient breadth in their knowledge. The categorization roughly follows the ACM Computing Classification System. Note that the following list is subject to changes due to removal and addition of courses.

| Category | Courses |
|----------|---------|
| Theory | COMPSCI 6E03, COMPSCI 6O03, COMPSCI 6TC3, COMPSCI 6TE3, 701, 702, 705, 706, 708, 722, 734, 736, 739, 744, 746, 749, 751, 758, 760, 763, 774, 775 |
| Software | SFWRENG 6HC3, 703, 704, 707, 720, 724, 725, 733, 738, 741a 743, 745, 756, 757, 761, 766 |
| Systems | SFWRENG 6WW3, COMPSCI 6F03, COMPSCI 6TB3, SFWRENG 6GA3, MECHTRON 6AX3, 721, 737, 747, 748, 750, 764, 765, 766, 767, 771, 772 |