STOCKHOLM UNIVERSITY

GENERAL SYLLABUS FOR PHD STUDIES IN MATHEMATICS
(incl. general syllabus for programs leading to a licentiate degree)

On 29 November 2002, the Stockholm University Board decided to allow admissions to third-cycle program leading to a licentiate degree. However, most admissions to third-cycle programs at Stockholm University should be to programs leading to a doctoral degree. In cases where a student has been admitted to a program leading to a licentiate degree, a new academic review and an analysis of the financial plan will be carried out if the student wishes to pursue a doctoral degree. The Board of Science has decided that decisions to admit research students to licentiate programs will be made by the relevant section dean.

The provision of third-cycle programs at any given time is dependent on resources.

Regulations regarding third-cycle programs can be found in the Higher Education Ordinance, Chapters 5-7, 10, 12 and Appendix 2, and in the Regulations for third-cycle programs at Stockholm University (SU 301-3153-10, or later decisions).

This study program was adopted by the Board of Science XXXXXX, revised 2011-XX-XX.

1. Subject description

Mathematics is a branch of natural science dealing with structures on sets. It has many different subareas such as logic, combinatorics, algebra, number theory, geometry and analysis. Mathematics has a history going back several thousand years and has become an indispensable help for economy, statistics, natural sciences, computer science, and technic.

2. Programme objectives

The purpose of education is to give foundational knowledge in different branches of mathematics, a good understanding of the methodology of mathematical research including the use of computers in purely mathematical research, general orientation in current research problems in at least one area, knowledge and skills sufficient to pursue an independent research. The goal of the education is to prepare a student for original research studies in mathematics or for other tasks requiring deeper knowledge of mathematics and its research methods.

The program leads to a licentiate or doctoral degree. The objectives defined for these degrees in the Higher Education Ordinance are presented in sections 5 and 6 below.

3. Prerequisites and entry requirements

Admission to third-cycle programs requires that the applicant meet the general entry requirements as well as the specific entry requirements, in addition to being otherwise capable of completing the training.

3.1 General entry requirements

A person meets the general entry requirements for third-cycle courses and study programs if he or she:

1. has been awarded a second-cycle qualification
2. has satisfied the requirements for courses comprising at least 240 credits of which at least 60 credits were awarded in the second-cycle, or
3. has acquired substantially equivalent knowledge in some other way in Sweden or abroad.

The Faculty Board may permit an exemption from the general entry requirements for an individual applicant, if there are special grounds.

3.2 Specific entry requirements

As specific entry requirements for acceptance to PhD studies in mathematics it is necessary that the applicant has acquired at least 90 points (or equivalent) in mathematics.
These should always include Algebra III (7,5 p), Foundation of Analysis (7,5 p), Analytic Functions (7,5 p) and a student paper on the advanced level worth at least 15 p.

Specific entry requirements are also satisfies by a person who somehow in Sweden or abroad has obtained similar knowledge.

4. Admission: selection

The decision of acceptance of students to PhD studies is prepared by a screening committee of the department. The screening committee should evaluate the applicants ability to succeed in PhD studies. The choice among the applicants is based on this evaluation.

Criteria for such evaluation are the familiarity with the theory within the chosen area, ability to express oneself orally and in the written form, knowledge of English, creativity, power of initiative, independence and ability to cooperate with others. To evaluate the applicant one uses the score for the courses (especially high level), the quality of the student paper, references, interviews, and a personal letter from the applicant explaining one's expectations and ambitions with the PhD studies. Applicant from abroad usually are tested to check the level of their knowledge.

The number of doctoral students admitted to third-cycle courses and study programs may not exceed the number that can be offered supervision and otherwise acceptable conditions for study and whose studies are funded. An applicant may be admitted if he or she is appointed to a doctoral studentship or has received a doctoral grant. An applicant with another type of funding may be admitted if the departmental board believes that funding can be secured throughout the training and the applicant is able to devote enough time to the training that it can be completed within eight years (four

years for a licentiate degree). Admission decisions are made in accordance with current delegation policies.

5. Programs leading to a doctoral degree

5.1 General information

Programs leading to a doctoral degree require four years of full-time study (240 higher education credits).

The PhD education consists the course part which is at least 100 p and the thesis part which is at least 120 p. Even if the course component precedes the thesis component, the doctoral student is encouraged to discuss the topic of the thesis at an early stage.

Much of the academic literature in the field of study is in English (other languages may occur as well). A prerequisite for being able to complete the program within the specified time limit is that the student has a good command of English.

Outcomes according to the Higher Education Ordinance

Knowledge and understanding

For the Degree of Doctor the third-cycle student shall

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialized knowledge in a limited area of this field, and
- demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For the Degree of Doctor the third-cycle student shall

- demonstrate the capacity for scholarly analysis and synthesis as well to review and assess new and complex phenomena, issues and situations autonomously and critically
- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work
- demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research
- demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general
- demonstrate the ability to identify the need for further knowledge and
- demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

Judgement and approach

For the Degree of Doctor the third-cycle student shall

- demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and
- demonstrate specialized insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

5.2 Individual study plan

An individual study plan must be drawn up for each doctoral student. The individual study plan should include:

- a research plan, including a timetable;
- information relating to how the supervision is organized;
- a plan of which courses/what type of courses the doctoral student is going to take;
- a description of other academic activities, such as participation in seminars and reading courses;
- a description of other obligations the student and the department may have during the training period;
- a financial plan covering the entire training period;
- if the training is not funded by means of employment or a doctoral grant, the financial plan should specify what social benefits apply to the type of funding in question, for example in the event of illness or parental leave.

The individual study plan should be drawn up in consultation with the doctoral student and his or her supervisor, and be followed up at least once a year. The individual study plan is approved in accordance with current delegation policies.

5.3 Courses

Courses include four (4) obligatory moments:

1. A student should follow the mandatory Introductory course in mathematical research (0 p) which gives some general information about the mathematical research both internationally and at the department.

2. A student has to pass the following advance courses in mathematics:

a) Advanced Linear Algebra (7,5p)
b) Advanced Real Analysis I (7,5p)
c) Elementary differential geometry (7,5p)
d) Advanced era Analysis II (7,5p)
e) Number theory (7,5p)
f) Topology (7,5p)
g) Elementary algebraic geometry (7,5p)

3. A student has to pass the following doctoral courses in mathematics:

a) Commutative algebra (7,5p)
b) Distribution theory (7,5p)

4. A student needs to participate in the seminar "Ethics in research" organized by the School of Natural Sciences

In exceptional cases one can substitute up to 15 p of courses mentioned in 5.3.2 and 5.3.3 above by other courses/topics on approval by the advisor and PhD program coordinator. The remaining courses are chosen by the student after consultations with the advisor. If one and the same course is given on the advanced and doctoral levels the student should follow the doctoral course.

Courses that were part of the specific entry requirements cannot be given credit for as part of the doctoral degree.

5.4 Thesis
As part of the training, the student will write an academic thesis.
The thesis should demonstrate the student's ability to independently – individually or as a team effort – carry out the selected research task using adequate academic methods. The thesis should be of such quality that it could be considered to meet reasonable requirements for publication in an academic journal of good quality. The doctoral thesis should be written either as a unified, coherent academic work (monograph) or as a compilation of academic papers with a short summary. The papers may be authored in cooperation with other people, but the doctoral student's contributions must be clearly distinguishable.

The thesis should be written in English.

5.5 Instruction
Courses mentioned in the previous section are not given every academic year. A student shoal be careful and use the opportunities given at each specific year. Courses given at KTH and Mittag-Leffler Institute could be of substantial interest for students.

Students should actively participate in research activities of the department, e.g. by attending seminars, colloquia and special guest lectures since one can obtain the general information about mathematics which is difficult to acquire otherwise. Students are also expected to actively participate in seminars, e.g. by giving own talks.

5.6 Supervision
Each doctoral student should be assigned a principal supervisor and at least one assistant supervisor. At least one of the supervisors should have received training in supervision or be considered to have corresponding qualifications.

A doctoral student is entitled to change supervisors upon request to the departmental board, in which case the individual study plan is revised.

Decisions regarding supervisors are made in accordance with current delegation policies.

The principal supervisor should inform the head of department about the student's progress on an annual basis. This is done through review of the individual study plans, which should be available at the department.

It is the principal supervisor's duty to assess, in consultation with the Board of Supervisors, when the student has made enough progress on his or her thesis that a date can be set for the public defense or licentiate seminar. For the licentiate seminar, the principal supervisor should also suggest an opponent and grading committee.

5.7 Examination and defense

In order to receive a degree, the student must have received a passing grade on the thesis and the courses included in the program. Each course is usually concluded with a written or oral examination. In some cases, continuous examination may take place during teaching sessions or laboratory work. Examinations are assessed using the grades Pass or Fail. A student who has passed an examination corresponding to a third-cycle course at one university unit is entitled to be given credit for this at another unit.

The thesis should be defended orally at a public defense seminar. The defense seminar should follow the regulations of the Faculty of Science at Stockholm University.

5.8. Additional information

6. Programs leading to a licentiate degree

6.1 General information

A third-cycle program comprising at least 120 credits, or a part comprising at least 120 credits of a third-cycle program leading to a doctoral degree, may be completed with a licentiate degree. The education consists of a thesis worth at least 60 p and courses worth at least 50 p. Although the course component precedes the thesis component, the student is encouraged to discuss the topic of the thesis at an early stage.

Much of the academic literature in the field of study is in English (other languages may occur as well). A prerequisite for being able to complete the program within the specified time limit is that the student has a good command of English.

Outcomes according to the Higher Education Ordinance

Knowledge and understanding

For a Degree of Licentiate the third-cycle student shall

- demonstrate knowledge and understanding in the field of research including current specialist

knowledge in a limited area of this field as well as specialized knowledge of research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For a Degree of Licentiate the third-cycle student shall have:

- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work
- demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and society in general, and
- demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

Judgement and approach

For a Degree of Licentiate the third-cycle student shall

- demonstrate the ability to make assessments of ethical aspects of his or her own research
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

6.2 Individual study plan

The individual study plan should be written the same way as for a doctoral degree; see 5.2.

6.3 Courses

Participation in the seminar "Ethics in research" is obligatory. Other compulsory moments are determined by the department's board. A student should take at least 37.5 p among the courses mentioned in 5.3.1. The remaining courses will be selected in consultation with the supervisor.

Courses that were part of the specific entry requirements cannot be given credit for as part of the licentiate degree.

6.4 Thesis

As part of the training, the student will write an academic thesis. The thesis should be of such quality that it could be considered to meet reasonable requirements for publication in an academic journal of good quality.

6.5 Instruction
Instruction is given in the same forms as in the doctoral programs; see 5.5.

6.6 Supervision
See 5.6.

6.7 Examination
The first paragraph of 5.7 also applies to the licentiate degree. The examination of a licentiate thesis takes place in connection with a publicly advertised licentiate seminar and should follow the regulations of the Faculty of Science at Stockholm University.

6.9. Additional information