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GRADUATE STUDY IN MATHEMATICS

AT THE

UNIVERSITY OF COLORADO AT BOULDER

The Department of Mathematics offers programs leading to the degrees Master of Arts in Mathematics, Master of Science in Applied Mathematics, and Doctor of Philosophy in Mathematics.

A student wishing to pursue graduate work in mathematics should carefully read the section of the University of Colorado catalog describing university requirements. The student is responsible for satisfying these requirements at the proper time.

PREREQUISITES FOR GRADUATE STUDY IN MATHEMATICS

To begin graduate work toward one of the degrees named above, a student should have at least 30 semester hours in mathematics, including, with grades of "B" or better, two semesters of analysis beyond lower division calculus, a semester of linear algebra, and a semester of either modern algebra or differential equations.

Students who do not have all the prerequisites for work toward the advanced degrees may still be admitted provisionally if, in the department's judgment, their records justify this. See the Graduate School provisional admission requirements in the University of Colorado catalog. A student who is admitted provisionally does not qualify for a Teaching Assistantship until the provisions are met.

The Graduate Record Examinations (GRE) are required and the Mathematics subject examination is highly recommended for all entering students, and will be part of the evaluation process. It is advisable to take these examinations as early as possible before the application deadline.

REQUIREMENTS FOR THE MASTER OF ARTS

DEGREE IN MATHEMATICS

The graduate committee or a member of the Graduate Faculty will act as the student's advisor. The student and the advisor should work out a degree plan. The advisor must approve the entire degree plan. There is no foreign language requirement for the M.A. degree. However, students who contemplate continuing for a Ph.D. should satisfy at least one of the foreign language requirements before obtaining a Master's degree. A grade point average of 3.0 in the student's course work is required. Master's students have four years to complete degree requirements**.**

PLAN I: THESIS OPTION

A student must complete 27 semester hours of graduate mathematics courses numbered 5000 or higher. Two of those courses must be approved full-year courses. No more than 6 hours of graduate seminars or independent study can be used as part of the requirements for the M.A. degrees. In addition to the course work the student must complete 4-6 hours of thesis work.

The thesis topic is to be chosen in consultation with the advisor. It is usually of an expository character and may be in any field of mathematics. Some theses may contain enough original work to be published. The student will give a 20-30 minute presentation on the thesis to a committee including the advisor and two other graduate faculty members, and will answer questions on the thesis.

PLAN II: NO THESIS OPTION

A student must complete 30 semester hours of graduate mathematics courses numbered 5000 or higher. Two of those courses must be approved full-year courses. No more than 6 hours of graduate seminars or independent study can be used as part of the requirements for the M.A. degrees.

A committee of three graduate faculty members shall, in consultation with the student, decide on a relatively specific topic for the student to prepare. The student will give a 20-30 minute presentation on the topic to the committee, and will answer questions on the topic.

OPTIONAL MINOR FIELD OUTSIDE MATHEMATICS

Students choosing a minor field outside of mathematics must complete 4-8 semester hours in an approved area. Proposed minor courses in a field other than mathematics must be approved by an advisor and by the minor department at least one semester before the degree is to be awarded. These courses may be numbered below 5000 if approved by the advisor and the graduate school.

REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE

IN APPLIED MATHEMATICS

To earn an M.S. Degree in Applied Mathematics from the Mathematics Department a student must meet the following requirements:

1. Completion of at least 30 semester hours of graduate course works, with a GPA of 3.0 or higher.

2. Of the 30 hours of graduate course work at least 18 must be in courses taken in the Department of Mathematics.

3. The 18 hours in the Department of Mathematics must include two (2) full-year sequences, one of which must be MATH 5600-5610, Numerical Analysis.

4. At least 6 hours in an area of application of mathematics in a course in some other department (e.g. Physics, Biology, Economics). An advisor must approve the outside area and course. The student can count up to 12 hours of courses in such an outside area towards the required 30 hours. These courses must include a full-year sequence in the area of application and must have the approval of an advisor. Up to 6 of these hours can be at the 4000 level.

5. The student must pass a written or oral Master's examination.

6. The student may replace 4-6 hours of course work with the writing and defending of a Master's thesis, which may be expository in nature. The writing of a thesis does not otherwise reduce any of the requirements (1)-(5) above.

REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE

IN MATHEMATICS

General admission requirements for the doctoral program are outlined in the first page of this booklet. See the University of Colorado catalog for certain course, residency, and communication requirements**.**

ACADEMIC REQUIREMENTS

A minimum of 60 semester hours of course work and thesis credit (combined) beyond the bachelor's degree will be required for all doctoral degrees within the Department. Of that minimum, students must complete at least 30 hours of course work in mathematics at or above the 5000 level. No more than 6 of these 30 hours may be from independent study courses. A student must complete a semester each of Complex Analysis and Topology and a second semester of one of these before taking the third portion of the Comprehensive Examination (see below). In addition to the course work the student must accumulate 30 hours of doctoral thesis credit.

A maximum of 10 dissertation hours accumulated prior to the semester the comprehensive examination is passed may be counted toward the required 30 hours. See the University of Colorado Catalog for further explanation of academic requirements for the Graduate school.

LANGUAGE REQUIREMENTS

1. A Ph.D. student is required to make written translations of mathematical articles in one Of the following languages: French, German, Italian, and Russian.

2. A Ph.D. student is required to demonstrate competency in a modern scientific programming language. This can be accomplished in the following ways:

a. Complete MATH 5600, Numerical Analysis, with a grade of B or better.
b. Take a class from the Computer Center; submit work to your advisor.
c. Pass an examination in C++ or Fortran.

These requirements should be completed before finishing the Comprehensive Examination.

COMPREHENSIVE EXAMINATION AND ADMISSION TO CANDIDACY

Before being admitted to candidacy for a Ph.D. degree in mathematics, a student must satisfy departmental course and language requirements and must pass the Comprehensive Examination. This examination consists of three parts: (1) a written examination in Algebra, (2) a written examination in Analysis, and (3) a third examination in an area to be agreed upon between the student and a faculty member (who agrees to serve as chair of the examining committee).

The examinations in Algebra and Analysis will be offered shortly before the beginning of each semester. Each of these examinations will be designed to take four hours. The examination will be constructed by committees of three members of the Graduate Faculty of the Department of Mathematics. These examinations (with acceptable solutions) will be submitted to the Graduate Committee for approval. The number of points assigned to each problem will be clearly indicated. Each examination will be graded by each member of the committee that constructed it, and a consensus grade of 0-100 submitted to the graduate committee. A grade of more than 70 is passing. Grades in the range of 55-70 may be given further consideration by the Graduate Committee, which may request opinions from some faculty members who have taught the students in question. A student will be allowed at most two attempts to pass each examination, and must attempt the first two before the fall semester of the second year of study.

The purpose of the third examination is to test the student's mastery of the subject material and assess the student's ability to do research in the area in question. A committee of at least five faculty members, who may specify either an oral or a written examination, administers it. Before taking the third part of the Comprehensive Examination all Ph.D. students must complete a semester each of Complex Analysis and Topology and a second semester of one of these.

Syllabi for the Algebra and the Analysis examinations will be prepared by the Graduate Faculty of the Department of Mathematics interested in each area. Students will be examined on the specific content of these syllabi. The syllabi are intended to be somewhat stable, and will not be changed without due consideration for students affected by the changes.

A student who enters the Ph.D. program with deficiencies may petition the Graduate Committee in writing for a time extension of no more than one year. A part-time student may request a special timetable for completing the examinations. These requests should be made in writing during the first year of study, approved by the Graduate Committee, and made a permanent part of the student's record.

Prior to, or upon completion of the Comprehensive Examination, the student should find a research advisor to direct a thesis. The student and thesis advisor should select a thesis committee. The thesis advisor and this committee may require examinations in the thesis area, and may require active participation in a seminar before agreeing to serve.

THE THESIS

Every candidate for the Ph.D. must write a thesis containing substantial original contributions to mathematics. A purely expository or historical thesis is not acceptable.

THE FINAL EXAMINATION AND THESIS DEFENSE

The final examination will cover the subject of the thesis and closely related topics, and will be approximately an hour and a half in length. This examination will be conducted by a committee consisting of the thesis advisor, the second reader, two other members of the Department of Mathematics and one faculty member from outside of the Department of Mathematics.

Upon fulfillment of these requirements, the candidate will be recommended to the Graduate School to receive the degree Doctor of Philosophy.

TIME LIMIT

All work, including the final examination, should be completed within six years from time of admission. Work done earlier will not be accepted for the degree unless validated by special examinations. A student is expected to complete the work with reasonable continuity.

SATISFACTORY PROGRESS FOR FUNDED STUDENTS

Funded students who keep to the relevant schedule below will be considered to be making satisfactory progress toward the M.A., M.S., or Ph.D. degree.

M.A. OR M.S. DEGREE

Year I. The student should complete a minimum of 15 semester hours of graduate study with a grade point average of 3.3 (or higher) for the first semester and a cumulative 3.5 every semester thereafter.

Year II. The student should complete an additional 15 semester hours of graduate study with a grade point average of 3.5 and fulfill all requirements for the degree.

PH.D. DEGREE

Year I. The student should complete a minimum of 15 semester hours with a grade point average of 3.3 (or higher) the first semester and 3.5 every semester thereafter. The course work should include anything needed as preparation for the written examinations in Algebra and Analysis. These examinations should be taken at the end of this year (August). The student should be working on the language requirement.

Year II. The student should complete a minimum of 15 additional semester hours of graduate study with a grade point average of 3.5. A student who did not begin with a deficiency will be required to take the written examinations in Algebra and Analysis before the beginning of the fall semester. In the fall of this year the student should begin to study for the third examination. The Student will be expected to fulfill the language requirement before the third examination, and should be working on fulfilling this requirement.

Year III. The student should complete a minimum of 12 additional semester hours of graduate study with a grade point average of 3.5; all departmental requirements including language requirements and the Comprehensive Examination should be completed during the fall semester.

Year IV. The student should be working with an advisor on a thesis and continuing active participation in course work and seminars. After completing the Comprehensive Examination a student working as a Teaching Assistant for the Mathematics Department is expected to register for at least one course per semester. The course may be taken for no credit.

THE GRADUATE FACULTY AND THEIR RESEARCH:

BAGGETT, LARRY W. - Professor, Ph.D. Washington (Seattle), 1966.
Modern analysis and Wavelets.

BROWN, GORDON E. - Associate Professor, Ph.D. Cornell, 1963.
Nonassociative Algebras.

CLELLAND, JEANNE NIELSEN -Assistant Professor, Ph.D. Duke 1996.
Geometry of Partial Differential Equations, Exterior Differential Systems and Cartan's Method of Equivalence.

CLELLAND, RICHARD - Assistant Professor, Ph.D. Duke. 1996.
Granular Flow, Fluid Flow, Molecular Dynamics, Solid Mechanics, Front Tracking, Adaptive Mesh Refinement, Numerical Methods for Hyperbolic Systems of Conservation Laws.

ELLIOTT, P.D.T.A. - Professor, Ph.D. Cambridge, 1969.
Number Theory.

ELLIS, HOMER G. - Associate Professor, Ph.D. Texas 1961.
Relativity Theory, Differential Geometry, Mathematical Physics.

FARSI, CARLA - Associate Professor, Ph.D. Maryland, 1989.
C Algebras, Noncommutative Differential Geometry.*

FOX, JEFFREY S. -Professor, Ph.D. California Berkeley, 1983.
Group Representations, Operator Algebras, Non-commutative Geometry and Operator K-theory, Computational Neurobiology.

GOODRICH, ROBERT K. - Professor, Ph.D. Utah, 1966.
Functional Analysis.

GOROKHOVSKY, ALEXANDER-Assistant Professor, Ph.D. Ohio State, 1999.
Noncummutatuive Geometry and Geometric Analysis.

GRANT, DAVID R. - Professor, Ph.D. MIT, 1985.
Number Theory.

GREEN, RICHARD M – Assistant Professor, Ph.D. Warwick 1995.
Algebra and combinatorics.

GUSTAFSON, KARL - Professor, Ph.D. Maryland, 1965.
Partial Differential Equations, Mathematical Physics.

HOLLEY, RICHARD A. - Professor, Ph.D. Cornell, 1969.
Probability, Statistical Mechanics.

KEARNES, KEITH - Associate Professor, Ph.D. University of California, Berkeley 1988.
Algebra, Logic, Discrete Mathematics.

KUZNETSOV, SERGEI -Associate Professor, Ph.D. Institute of Mathematics of Ukrainian Academy of Sciences.
Stochastic Processes and their applications to PDE's.

LAVER, RICHARD J. - Professor, Ph.D. California Berkeley, 1969.
Set Theory.

MONK, DONALD J. - Professor, Ph.D. California Berkeley, 1961.
Logic, Boolean Algebra.

PACKER, JUDITH A. – Professor, Ph.D. Harvard University 1982.
Operator Algebras, K-Theory and Cohomology and their relations to discrete groups and C -Algebraic Dynamical Systems, Wavelets.*

STADE, ERIC - Professor, Ph.D. Columbia, 1988.
Number Theory.

SZENDREI, AGNES E.-Associate Professor, Ph.D. Hungarian Academy of Sciences, 1982
Algebra, Combunatorics, Logic.

TAYLOR, WALTER - Professor, Ph.D. Harvard, 1968.
General Algebra, Topological Algebra, Computer Graphics.

TUBBS, ROBERT - Associate Professor, Ph.D. Penn State, 1981.
Transcendental Number Theory, History of Math.

WALLING, LYNNE - Professor, Ph.D. Dartmouth, 1987.
Number Theory.

WALTER, MARTIN E. - Professor, Ph.D. California Irvine, 1971.
Noncommutative Harmonic Analysis, Mathematics for the Environment.

WANG, BIN – Assistant Professor, Ph.D. Brown University 1994.
Algebraic Geometry.

WU, SIYE – Associate Professor, Ph.D. MIT, Cambridge, MA.
Analysis, Geometry, Topology, Mathematical Physics.