Our graduate program

Over the past half-century, the Department of Mathematical Sciences at the University of Delaware has awarded well over one hundred doctoral degrees in Mathematics and Applied Mathematics. In 2010, the NRC rankings of doctoral programs ranked our program in the range 11-40 among all U.S. programs in mathematics, while the Academic Ranking of World Universities consistently identifies us as a top 100 department in mathematics worldwide. We offer five-year financial aid packages combining teaching, research, and fellowship opportunities, a beautiful campus in a lively town, and a central location in the mid-Atlantic on the Eastern seaboard. Our faculty contains internationally recognized researchers in core areas of mathematics and its applications. As such, we offer a wide range of potential research topics for Ph.D. candidates. Graduates from our program have gone on to prestigious postdoctoral research positions, tenure-track positions combining research and teaching, and jobs in industry, commerce, and in government agencies, such as the National Security Agency.

The department currently offers master’s and doctoral degrees in Mathematics and Applied Mathematics. Generally speaking, the Ph.D. requires full-time study. In summary, the requirements for the Ph.D. are:

- 48 credits of coursework (16 courses), including up to six credits from outside math (may be decreased for those entering with a master’s).
- A written Preliminary Examinations in analysis and linear algebra.
- An oral Candidacy Examination on topics selected for relevance to the candidate’s research.

Mathematicians in the Senate

In the past academic year, three math graduate students were strongly involved in the Graduate Student Senate. PhD candidate Chris Castillo (left) was elected President of the GSS, while fourth year Isaac Harris became Parliamentarian. Freshman Nick Kaufman represents the department in the Senate. Part of the mission of the GSS is “to create a forum for graduate student advocacy, while acting as a conduit between students, faculty and administration.” The GSS enlivens the university by organizing social and networking activities. Among other things, the GSS contributed to the reopening of the faculty and graduate lounge, located at the basement of Wright House, and called the Speakeasy.
Our courses

The graduate program offers over twenty graduate courses at different levels of specialization. Students are also encouraged to take some courses outside the department in order to broaden the scope of their expertise.

Every spring, the department proposes two topic courses, appealing to research and educational interests of faculty and students. In 2013, these courses were taught by Professors Edwards (Introduction to Mathematical Finance) and Linde (Gaussian Random Processes), while 2014 will feature courses on Distributions and Fourier Transforms (Prof. Rakesh) and Hot topics in Finite Fields and their Applications (Prof. Coulter).

(600) Fundamentals of Real Analysis
(602) Measure, Integration, and Complex Variables
(611) Introduction to Numerical Discretization
(612) Computational Methods for Equation Solving and Function Minimization
(616) Modeling in Applied Mathematics
(617) Techniques in Applied Mathematics
(630) Probability Theory and Applications
(631) Introduction to Stochastic Processes
(650) Algebra I
(672) Vector Spaces
(688) Combinatorics and Graph Theory I
(806) Functional Analysis
(810) Asymptotic and Perturbation Methods
(817) Introduction to Numerical Methods for Partial Differential Equations
(829) Topics in Mathematics
(835) Evolutionary Partial Differential Equations
(836) Elliptic Partial Differential Equations
(838) Finite Element and Boundary Element Methods
(845) Algebra II
(850) Theory of Probability
(888) Combinatorics II

Expanding your horizons

Five regular research seminars (Applied Mathematics, Mathematical Medicine and Biology, Discrete Mathematics, Inverse Problems and Analysis, Numerical Analysis and PDE, Probability) and the Teaching Seminar give faculty and graduate students opportunities to interact with visitors from other universities and research centers in their areas of interest, and to learn first hand state of the art techniques and results in mathematics.

The Departmental Colloquium and the Carl J. Rees Special Lectures cater for a wider audience. Distinguished visitors and faculty members address the entire department with engaging talks on their research. In 2013-14 the colloquium speakers were Professors Ou and Cirillo from UD, Miura from NJIT, Ghrist from U. Pennsylvania, Cockburn from U. Minnesota, Layton from U. Pittsburgh.

The beginning of the spring semester sees the Winter Research Symposium, with senior students presenting their work in talks and posters. The WRS is articulated around a keynote address by a successful UD graduate (in 2014, Prof. Madiman stood for the invited speaker due to an untimely winter storm). Shixu Meng and Tianyu Qiu were awarded travel grants for the posters they presented.
Networking opportunities

The department is actively involved in the organization of several research meetings. Every summer, for more than thirty years, leading applied mathematicians for universities, industry and national labs join forces for the workshop on Mathematical Problems in Industry. UD is one of the principal organizers of this series, which will come back to the Newark campus in Summer 2015.

Since 2012, computational mathematicians from Delaware meet their colleagues in Maryland and surrounding states for the DelMar Numerics Day. The Spring 2014 edition took place in the UMBC campus. The mathematics departments at UD and UMD College Park organize this yearly event.

For the fifth time in its almost four decades of life, the biannual Finite Element Circus came to Delaware in Fall 2013. The FEC is a fast-paced conference where the latest results in the finite element method are discussed in laid-back atmosphere.

Math in the summer

Summers are a busy time at the Department of Mathematical Sciences. In addition to regular research activities and the summer session teaching, students get involved in different ways.

Freshmen get a first taste of research with faculty through UNIDEL fellowships and with the GEMS program. The Groups Exploring the Mathematical Sciences are made up of teams of a faculty advisor, a first year graduate student, and an undergraduate. Seven teams were created in Summer 2014, working on varied topics including information theory, computational elasticity, numerical fluid dynamics, mathematical medicine and graph theory. The UNIDEL-GEMS summer program includes a weekly pizza seminar and wraps up in the Summer Research Symposium.

The incoming graduate student class gets a chance to meet each other and faculty while preparing for the start of the year in the GRIPS (Graduate Review of Important Problems for Success) program. Six modules (Linear Algebra, Analysis, ODEs, Numerical Computing, Multivariable Calculus, and Discrete Math) to refresh from, and plenty of social interaction fill four weeks of learning and entertainment.

More senior students get to participate in different summer programs in the US and abroad. In 2014, these included long term visits to Ecole Polytechnique in Paris (France), NSF-CBMS conferences at Dartmouth College and UT Arlington, two MSRI summer schools in UC Berkeley, the IMA Industrial Workshop at the University of British Columbia (Canada), the Mathematical Problems in Industry workshop at New Jersey Institute of Technology, an RMMC Summer school in Wyoming, the CIME School on Computational Electromagnetism in Cetraro (Italy), the J.L.Lions French-Spanish School on Numerical Simulation in Pamplona (Spain), the PCMI-IAS school on Mathematics and Materials in Park City, Utah, and the first IMA Special Workshop on Careers and Opportunities in Industry.

Meeting your peers

The Delaware chapter of the Society of Industrial and Applied Mathematics (SIAM), led by Jake Rezac, and the local chapter of the Association for Women in Mathematics (AWM), presided by Yun Zeng, invited external speakers to discuss their research and career development post graduation in an informal setting. The students chapters organize a variety of non-academic get-togethers to unwind after long days of work.

The Hallenbeck Graduate Student Seminar meets at lunch time once a week, with free food and lively presentations from the research of current students, as well as discussion panels on issues of interest (preliminary and candidacy exams, summer opportunities and internships). The organization of the HGSS fell to Matt Hassell and Isaac Harris. The winter session brings opportunities for students preparing for the Preliminary Exams to review the material under the mentoring of senior peers.
2013-14 Graduates

PhD Graduates
- **Brooks Emerick.** Modeling molecular and tissue dynamics in the human colonic cript: an investigation into colon cancer development. (Advisor: Prof. Schleiniger)
- **Wu Fan.** Strongly regular graphs, association schemes and Gauss sums. (Advisor: Prof. Xiang)
- **Zhixing Fu.** Contributions to the study of the Hybridizable Discontinuous Galerkin Method. (Advisor: Prof. Sayas)
- **Qunhui Han.** Analysis and simulation of exit time problems. (Advisor: Prof. Fok)
- **Alexander Kodess.** Properties of some algebraically defined graphs. (Advisor: Prof. Lazebnik)
- **Longfei Li.** Mathematical models and numerical methods for human tear film dynamics. (Advisor: Prof. Braun)

MSc Graduates
Sarah E. Cates, Douglas B. Freeman, Christine A. Rakowski, Jindang Zhao

Research areas
- Algebra
- Combinatorics
- Inverse Problems
- Mathematical Biology
- Numerical Analysis
- Physical Applied Mathematics
- Probability
- Scientific computing
- Stochastics