

# Ph.D. in Mathematical Sciences

## Degree Requirements

Ph.D. students are admitted to the applied mathematics track or the applied statistics and probability track. In either track, students must fulfill the requirements for the doctor of philosophy as specified in this catalog. Students entering with a bachelor's degree must complete 36 credits of coursework. Those students entering with a master's degree in mathematical sciences or equivalent must complete 12 credits of advanced 700-level coursework. Specific courses of study are planned in consultation with a faculty advisor and are subject to approval. In general, students are encouraged to take courses both in mathematics and in areas of application. To graduate, students must have an approved dissertation and are expected to attain an overall GPA of at least 3.0.

Seminar: In addition to the minimum degree credits required, all doctoral students must enroll each semester in MATH 791 (<https://catalog.njit.edu/search/?P=MATH%20791>) Graduate Seminar.

Ph.D. in Mathematical Sciences (students with a Master's degree in Mathematical Sciences or equivalent)

Code	Title	Credits
Electives		
700-level courses <sup>1</sup>		12
Dissertation		
MATH 790A	Doct Dissertation & Res	
MATH 792B	Pre Doctoral Research <sup>2</sup>	
Seminar		
MATH 791	Graduate Seminar <sup>3</sup>	
<b>Total Credits</b>		<b>12</b>

<sup>1</sup> No more than 6 credits may be [MATH 725](#) Independent Study. 700-level courses may be substituted by 600-level courses if the academic advisor appeals on behalf of the student to the Office of Graduate Studies and receives approval. Whether or not a program requires additional courses above the aforementioned minimum requirements, a Ph.D. student's dissertation committee may ask the student to take additional courses.

<sup>2</sup> Ph.D. students who pass the written and oral qualifying examination must then register for the 3-credit pre-doctoral research course (MATH 792B) each semester until they defend successfully the dissertation proposal. Students who defend the dissertation proposal successfully must then register for the 1-credit dissertation course (MATH 790A) each semester until they complete all degree requirements. Students may take courses simultaneously with the 790A or 792B course as per Ph.D. program guidelines or dissertation committee recommendation.

<sup>3</sup> Students must register eight semesters for this seminar. Part-time students may request that this requirement be waived for some semesters.

Ph.D. in Mathematical Sciences (students with a Bachelor's degree in Mathematical Sciences or equivalent)

Code	Title	Credits
Electives		
600 and 700-level courses <sup>1</sup>		36
Dissertation		
MATH 790A	Doct Dissertation & Res	
MATH 792B	Pre Doctoral Research <sup>2</sup>	
Seminar		
MATH 791	Graduate Seminar <sup>3</sup>	
<b>Total Credits</b>		<b>36</b>

<sup>1</sup> Ph.D. students with a recognized Baccalaureate degree are required to take eight 600-level or 700-level 3-credit courses (24 credits) of coursework as well as four additional 700-level 3-credit courses (12 credits), for a total of twelve 3-credit courses (36 credits). No more than 6 credits may be [MATH 725](#) Independent Study. 700-level courses may be substituted by 600-level courses if the academic advisor appeals on behalf of the student to the Office of Graduate Studies and receives approval. Whether or not a program requires additional courses above the aforementioned minimum requirements, a Ph.D. student's dissertation committee may ask the student to take additional courses.

<sup>2</sup> Ph.D. students who pass the written and oral qualifying examination must then register for the 3-credit pre-doctoral research course (MATH 792B) each semester until they defend successfully the dissertation proposal. Students who defend the dissertation proposal successfully must then register for the 1-credit dissertation course (MATH 790A) each semester until they complete all degree requirements. Students may take courses simultaneously with the 790A or 792B course as per Ph.D. program guidelines or dissertation committee recommendation.

<sup>3</sup> Students must register eight semesters for this seminar. Part-time students may request that this requirement be waived for some semesters.

Courses: A typical schedule of courses for the first two semesters in Applied Mathematics consists of the following:

### First Year

1st Semester		Credits
MATH 599	Teaching in Mathematics	3
MATH 613	Advanced Applied Mathematics I: Modeling	3
MATH 631	Linear Algebra	3
MATH 645	Analysis I	3
MATH 651	Methods of Applied Mathematics I	3
<b>Term Credits</b>		<b>15</b>
2nd Semester		Credits
MATH 614	Numerical Methods I	3
MATH 656	Complex Variables I	3
MATH 689	Advanced Applied Mathematics II: Ordinary Differential Equations	3
MATH 745	Analysis II	3
<b>Term Credits</b>		<b>12</b>
<b>Total Credits</b>		<b>27</b>

Courses: A typical schedule of courses for the first two semesters in Applied Probability and Statistics consists of the following:

### First Year

1st Semester		Credits
MATH 599	Teaching in Mathematics	3
MATH 631	Linear Algebra	3
MATH 644	Regression Analysis Methods	3
MATH 645	Analysis I	3
MATH 662	Probability Distributions	3
<b>Term Credits</b>		<b>15</b>
2nd Semester		Credits
MATH 665	Statistical Inference	3
MATH 699	Design and Analysis of Experiments	3
MATH 745	Analysis II	3
MATH 768	Probability Theory	3
<b>Term Credits</b>		<b>12</b>
<b>Total Credits</b>		<b>27</b>

Also, there are advanced courses in:

- partial differential equations
- ordinary differential equations and dynamical systems
- optimization
- numerical methods
- computational electromagnetics
- computational fluid dynamics
- computational neuroscience
- financial mathematics
- integral equations
- materials science
- probability and statistics

### Deadlines

- The required coursework for the Ph.D. program and the major part of the qualifying exams must be completed successfully by the end of the second year in the program. The written exams are typically completed by the end of the first summer, and the oral exam by the end of the second year.
- The dissertation proposal must be defended successfully by the end of the third year in the Ph.D. program.
- The dissertation must be defended successfully by the end of the sixth year in the Ph.D. program.

### Selection of Dissertation Advisor

Students select a dissertation topic and advisor in the second year of the program. In cases where more than one advisor is directing the dissertation, the primary advisor must be on the core departmental faculty.

### Qualifying Examination

**Applied Mathematics track:** The qualifying examination for the applied mathematics track consists of a preliminary examination in three parts and an oral examination. The three components of the preliminary examination are: Applied Mathematics, Analysis, and Linear Algebra-Numerical Methods. Students must achieve a grade of A in each component to pass the preliminary examination and proceed to the oral examination. Components may be passed at different times. However, a student may attempt each component at most twice and must pass all three components before taking the oral examination. The qualifying examination must be passed by the end of the second year in the program. Typically, two opportunities to take each component are provided each year: Applied Mathematics (January and May), Analysis and Linear Algebra-Numerical Methods (May and August). The oral examination is usually offered in January and May. The oral exam is intended to test the students research readiness. Exam topics are chosen in consultation with the Ph.D. advisor, and include research papers and coursework relevant to the dissertation topic.

**Applied Probability and Statistics track:** The qualifying examination for the applied probability and statistics track consists of a preliminary examination in three parts and an oral examination. The three components of the preliminary examination are: Probability Distributions and Regression Analysis Methods, Real Analysis and Statistical Inference, Probability Theory and Design and Analysis of Experiments. Students must achieve a grade of A in each component to pass the preliminary examination and proceed to the oral examination. Components may be passed at different times. However, a student may attempt each component at most twice and must pass all three components before taking the oral examination. The qualifying examination must be passed by the end of the second year in the program. Typically, two opportunities to take each component are provided each year: Probability Distributions and Regression Analysis Methods (January and May), Real Analysis and Statistical Inference and Probability Theory and Design and Analysis of Experiments (May and August). The oral examination is usually offered in January and May. The oral exam is intended to test the students research readiness. Exam topics are chosen in consultation with the Ph.D. advisor, and include research papers and coursework relevant to the dissertation topic.

### Dissertation Committee

The dissertation committee is an important resource for the doctoral student in the conduct of research for their dissertation. According to the regulations specified in this catalog, doctoral students are required to have a dissertation advisor selected, a dissertation committee formed, and research proposal approved within one year of passage of the qualifying examination.

### Dissertation Proposal

Doctoral students must prepare a research proposal for approval by their dissertation committee. The student must offer an oral defense of this proposal before the dissertation committee and obtain its approval within one year of passing the qualifying examination. The committee determines if the proposal has an appropriate objective, if there is a reasonable plan to reach that objective, and if the student possesses the knowledge and skills needed to carry out the plan. The dissertation proposal can only be approved by unanimous consent of the committee members.

### Dissertation Defense

A public oral defense of the dissertation before the dissertation committee is required. All members of the committee must be present for the defense. Success of the defense is determined by a majority vote of the dissertation committee.