University of Maryland

AMSC Advising Packet

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Summary of PhD Tracks

Applied Mathematics

35 Credits of Coursework

- 18 Credits - Core mathematical content courses
- 6 Credits - Application courses
- 9 Credits - Electives
- 2 Credits - Seminars/RITs (Research Interaction Teams)

12 Credits of 899 Dissertation Research Credits

3 Qualifying Exams

- At least 1 must be a Math Written Exam and 1 must be an exam or coursework sequence in an application area

Applied Statistics

33 Credits of Coursework

- 18 Credits - Core statistics courses
- 6 Credits - Application courses
- 3 Credits - Electives
- 2 Credits - Seminars/RITs (Research Interaction Teams)
- 3 Credits - Practicum/Internship
- 1 Credit - Data Analysis Project

12 Credits of 899 Dissertation Research Credits

Mathematical Statistics Written Exam

Applied Statistics Written Exam

Scientific Computation

36 Credits of Coursework

- 18 Credits - Core scientific computation courses
- 6 Credits - Core science courses
- 6 Credits - Computation courses supporting application area
- 6 Credits - Electives

12 Credits of 899 Dissertation Research Credits

No qualifying exam requirements

Summary of Masters Tracks

Applied Mathematics

Masters (Without Thesis)

30 Credits of Coursework

- 15 credits - Core mathematical content courses
- 6-9 credits - Application courses
- 1 credit - Seminar and RIT
- Remaining credits - Electives

Qualifying Exam: Pass three exams with a Master's level score.

Scholarly Paper: Write a Scholarly Paper on an acceptable topic in applied math or scientific computation.

Masters (With Thesis)

At least 24 Credits of Coursework

- 12 credits - Core mathematical content courses
- 6-9 credits - Application courses
- 1 credit - Seminar and RIT
- Remaining credits - Electives

Plus 6 credits - thesis research

Thesis: Write and present a thesis before an Examination Committee under the guidance of advisors.

Applied Statistics

Masters (Without Thesis)

33 Credits of Coursework

- 18 credits - Statistics core courses
- 6 credits - Application courses
- 6 credits - Electives
- 2 credits - Seminars and RITs
- 1 credit - Data Analysis Project

Qualifying Exams: Pass three exams with a Master's level score.

Scholarly Paper: Write a Scholarly Paper on an acceptable topic in an applied statistics topic.

Masters (With Thesis)

25 Credits of Coursework

- 18 credits - Statistics core courses
- 6 credits - Application courses
- 1 credit - Seminar

Plus 6 credits - M.S. thesis research

Thesis: Write and present a thesis before an Examination Committee under the guidance of advisors.

Scientific Computation

Masters (Without Thesis)

30 Credits of Course

- 9 credits in - AMSC660-661 and CMSC616
- 6 credits in - AMSC714, AMSC715, AMSC808N, AMSC763, or AMSC764
- 6 credits - Core science courses
- 3 credits - SC Application courses
- 6 credits - Electives

Scholarly Paper: Write a Scholarly Paper on an acceptable topic in an applied math or scientific computation topic.

Masters (With Thesis)

24 Credits of Coursework

- 9 credits in - AMSC660-661 and CMSC616
- 6 credits - Core science courses
- 3 credits - SC Application courses
- 6 credits - Electives

Plus 6 credits - thesis research

Thesis: Write and present a thesis before an Examination Committee under the guidance of advisors.

Qualifying Exam Requirements

Qualifying exams are given in August and in January each year. The tests are free and you may retake the exams until you pass.

Math Department's Written Qualifying Exams:

- Applied Statistics
- Probability
- Algebra
- Analysis
- Mathematical Statistics
- Geometry

Applied Mathematics

- Three total qualifying exams:
  - Math Department Written Qual (student's choice)
  - Application Area Qual (Written Exam or course sequence)
    - https://amsc.umd.edu/app-area-qual-exam.html
  - A third Qual
    - Additional Math Written Qual, OR
    - Additional Application Area Qual, OR
    - Coursework sequence from the list at https://amsc.umd.edu/academics/program-concentrations/applied-mathematics/applied-mathematics-qualifying-exam-requirements.html

Applied Statistics

- Three total qualifying exams:
  - Mathematical Statistics (Math Department Written Qual)
  - Applied Statistics (Math Department Written Qual)
  - Multivariate Analysis and Statistical Computing course sequence
    - Multivariate Analysis: One of STAT702, STAT707, STAT 730, STAT750, EMS657/769M, BMGT837, or BIOM621
    - Statistical Computing:
      - STAT705, or
      - AMSC 660 plus one Applied Statistical Computing course in an outside department

Scientific Computing

- No qualifying exam requirements

PhD Progress to Degree

Students in the AMSC program are expected to make reasonable progress toward their degree. In the following charts, a supported student is one who receives funding from the Mathematics Department as a TA, GA, as a fellow, or funding from other affiliate units.

Applied Mathematics Concentration

By the end of	Ideal Progress	To maintain support	To remain in program
1st Year	Prepare for and pass 2 qualifying exams.	Pass 12 credit hours with at least a 3.0 GPA.	Pass 24 units each term with at least a 3.0 GPA.
2nd Year	Pass third exam, choose field/advisor, and advance to candidacy.	Pass 1 exam by January, and pass 24 credit hours with 3.0 GPA.	Pass 24 units each term with at least a 3.0 GPA.
3rd Year	Make good progress toward finishing dissertation.	Pass all exams by January, and remain enrolled full-time.	Pass all three exams by January.
4th Year	Finish dissertation, and apply for jobs.	Reach candidacy by March 1.	Pass 24 units each term with at least a 3.0 GPA.
5th Year		Make good progress toward finishing dissertation.	Pass 24 units each term with at least a 3.0 GPA, and reach candidacy.
6th Year	Last year of support eligibility	Last year of support eligibility	Last year of support eligibility

Applied Statistics Concentration

By the end of	Ideal Progress	To maintain support	To remain in program
1st Year	Prepare for and pass 2 qualifying exams. Complete STAT 700, 701, 740, 741.	Pass 12 credit hours with 3.0 GPA.	Pass 24 units each term with at least a 3.0 GPA.
2nd Year	Complete both a Statistical Computing course and a Multivariate Analysis course with at least a 3.5 GPA. Complete all core courses and application courses.	Pass 1 exam by January, and pass 24 credit hours with 3.0 GPA.	Pass 24 units each term with at least a 3.0 GPA.
3rd Year	Complete Data Analysis Project, and advance to candidacy.	Pass all exams by January, and remain enrolled full-time.	Pass all three exams by January.
4th Year	Complete practicum, and make good progress toward finishing dissertation.	Complete Data Analysis Project, and reach candidacy by March 1	Pass 24 units each term with at least a 3.0 GPA and complete the Data Analysis Project.
5th Year	Finish dissertation, and apply for jobs.	Make good progress toward finishing dissertation.	Pass 24 units each term with at least a 3.0 GPA, and reach candidacy.
6th Year	Last year of support eligibility	Last year of support eligibility	Last year of support eligibility

Scientific Computation Concentration

By the end of	Ideal Progress	To maintain support	To remain in program
1st Year	Complete AMSC 660, AMSC 661, and CMSC 616, plus one Core Science Course, with a 3.5 GPA.	Pass 12 credit hours with 3.0 GPA.	Pass 24 units each term with at least a 3.0 GPA.
2nd Year	Complete all core courses with a 3.5 GPA.	Complete all core courses, each with a B or better, and pass 24 credit hours, with a 3.0 GPA	Complete all core courses, each with a B or better, and pass 24 units each term with at least a 3.0 GPA
3rd Year	Reach candidacy, and make good progress toward dissertation.	Complete all core and core science courses, with 3.5 GPA in these courses, by the end of the third year, and remain enrolled full-time	Complete all core and core science courses by the end of the third year
4th Year	Make good progress toward finishing dissertation.	Reach candidacy by March 1.	Pass 24 units each term with at least a 3.0 GPA.
5th Year	Finish dissertation during first semester, and apply for jobs.	Make good progress toward finishing dissertation.	Pass 24 units each term with at least a 3.0 GPA, and reach candidacy.
6th Year	Last year of support eligibility	Last year of support eligibility	Last year of support eligibility

AMSC PhD GPA Requirement Summary*

**To retain departmental funding*

Applied Mathematics

- 1st year of 12 credits: 3.0 GPA overall
- 2nd year of 24 credits: 3.0 overall
- Core coursework: 3.0 GPA overall
  - 3-course Qual work, at least B or 3.0 in each class, and 3.5 GPA overall
- Overall GPA of B or 3.0 in all included coursework
- No course with an individual grade below B- or 2.7 can be included in study plan

Applied Statistics

- 1st year of 12 credits: 3.0 GPA overall
- 2nd year of 24 credits: 3.0 overall
- Core coursework: 3.0 GPA overall
- Multivariate Analysis and Statistical Computing Course Sequence, 3.5 GPA overall
- Overall GPA of B or 3.0 in all included coursework
- No course with an individual grade below B- or 2.7 can be included in study plan

Scientific Computation

- 1st year of 12 credits: 3.0 GPA overall
- 2nd year of 24 credits: 3.0 overall
- At least B or 3.0 in each core class (does not include core science courses)
- Overall GPA of 3.5 in SC core courses and core science courses
- Overall GPA of B or 3.0 in all included coursework
- No course with an individual grade below B- or 2.7 can be included in study plan

AMSC MS GPA Requirement Summary

Applied Mathematics

- Overall GPA of 3.0 in all included coursework, and no individual course grade below a B- (2.70)
- 3-course Qual work, at least B- or 2.70 in each class, and 3.0 GPA overall
- 2-course Qual work (in application area), at least B- or 2.70 in each class, and 3.0 GPA overall

Applied Statistics

- Core coursework: 3.0 GPA overall
- Multivariate Analysis and Statistical Computing Course Sequence, 3.0 GPA overall
- Overall GPA of 3.0 in all included coursework, and no individual course grade below a B- (2.70)

Scientific Computation

- Overall GPA of 3.0 in SC core courses and core science courses
- Overall GPA of 3.0 in all included coursework, and no individual course grade below a B- (2.70)

Applied Math Track Math Content Courses

Courses satisfying the requirement of containing "primarily mathematical content" for the Applied Math (AM) concentration within the AMSC program. *All courses are 3 credits unless stated otherwise.*

- MATH 600 Abstract Algebra I
- MATH 601 Abstract Algebra II
- MATH 602 Homological Algebra
- MATH 603 Commutative Algebra
- MATH 606 Algebraic Geometry I
- MATH 607 Algebraic Geometry II
- MATH 620 Algebraic Number Theory I
- MATH 621 Algebraic Number Theory II
- MATH 630 Real Analysis I
- MATH 631 Real Analysis II
- MATH 632 Functional Analysis
- MATH 634 Harmonic Analysis
- MATH 636 Representation Theory
- MATH 642 Dynamical Systems I
- MATH 643 Dynamical Systems II
- MATH 660 Complex Analysis I
- MATH 661 Complex Analysis II
- MATH 670 Ordinary Differential Equations I
- MATH 671 Ordinary Differential Equations II
- MATH 673 Partial Differential Equations I
- MATH 674 Partial Differential Equations II
- MATH 712 Mathematical Logic I
- MATH 713 Mathematical Logic II
- MATH 730 Fund Concepts of Topology
- MATH 734 Algebraic Topology
- MATH 740 Fundamental Concepts of Differential Geometry
- MATH 742 Geometric Analysis
- MATH 744 Lie Groups I

- STAT 600 Probability Theory I
- STAT 601 Probability Theory II
- STAT 650 Applied Stochastic Processes
- STAT 658 Advanced Applied Stochastic Processes II
- STAT 700 Mathematical Statistics I
- STAT 701 Mathematical Statistics II
- STAT 702 Survival Analysis
- STAT 705 Computational Statistics
- STAT 710 Advanced Statistics I
- STAT 730 Time Series Analysis
- STAT 740 Linear Statistical Models I
- STAT 741 Linear Statistical Models II
- STAT 750 Multivariate Analysis
- STAT 770 Analysis of Categorical Data

- *AMSC 660 Scientific Computing I
- *AMSC 661 Scientific Computing II
- *AMSC 665 Scientific Computing III
- AMSC 698Q The Mathematics of Quantum Information Science
- *AMSC 714 Numerical Methods for Stationary PDEs
- *AMSC 715 Numerical Methods for Evolution Partial Differential Equations
- AMSC 721 Mathematical Population Biology
- *AMSC 763 Advanced Linear Numerical Analysis
- *AMSC 764 Advanced Numerical Optimization

Note

*starred AMSC courses meet the numerical analysis course requirement.

Scientific Computation Track Core Science Courses

Every Scientific Computation student is expected to apply computational methods in a science discipline. The core science courses are intended to provide students with a foundation in their chosen discipline. They must be graduate-level (600-level or above) core courses from a discipline outside Mathematics and Computer Science. (The word "science" should be considered an abbreviation for "physical science, life sciences, engineering, business, and social science".) The following are examples of courses that might be appropriate as core science courses:

Aerospace Engineering

- ENAE 674 Aerodynamics of Compressible Fluids
- ENAE 684 Computational Fluid Dynamics I
- ENAE 685 Computational Fluid Dynamics II

Astronomy

- ASTR 600 Stellar Atmospheres
- ASTR 605 Stellar Interiors and Evolution
- ASTR 620 Galaxies
- ASTR 640 Radiation and Plasma Processes
- ASTR 670 Interstellar Matter

Atmospheric Sciences

- AOSC 610-611 Dynamics of the Atmosphere and Ocean I and II
- AOSC 620-621 Physics and Chemistry of the Atmosphere I and II
- AOSC 647 Machine Learning in Earth Science

Business and Management

- BMGT 830 Linear Programming
- BMGT 834 Operations Research: Probabilistic Models

Electrical & Computer Engineering

- ENEE 620 Random Processes in Communication and Control
- ENEE 627 Information Theory
- ENEE 631 Digital Image and Video Processing
- ENEE 651 Parallel Algorithms

Fluid Dynamics

- ENME 640 Fundamentals of Fluid Mechanics
- ENME 641 Viscous Flow
- ENME 642 Hydrodynamics

Geology/Geophysics

- GEOL 614 Thermodynamics of Geological Processes
- GEOL 641 Advanced Structural Geology
- GEOL 646 Crustal Petrology

Physics

- PHYS 601 Theoretical Dynamics
- PHYS 606 Electrodynamics
- PHYS 622-625 Quantum Mechanics series

Other

- BIOM 601 Biostatistics I
- CMSC 723 Natural Language Processing
- ENME 725 Probabilistic Optimization
- ENME 741 Operations Research Models in Engineering
- NACS 643 Computational Neuroscience

Scientific Computation Track Applications Courses

Applications Courses are intended to expose students to computational methods and mathematical modeling that is relevant to their science discipline. The content of approved courses must be primarily in mathematics or computational science. The following examples illustrate courses that might be appropriate as Scientific Computation application courses:

Applied Numerical Methods PDE/ODE

- AMSC 714 Numerical Methods For Stationary PDEs
- AMSC 715 Numerical Methods for Evolution Partial Differential Equations
- CMSC 714 High Performance Computing Systems
- AMSC 763 Advanced Linear Numerical Analysis
- ENAE 653 Nonlinear Finite Element Analysis
- ENME 674 Finite Element Methods

Numerical Methods in Sciences

- ASTR 698C Computational Astrophysics
- ENAE 652 Computational Structural Mechanics
- ENAE 684,685 Computational Fluid Dynamics I and II
- ENCH 739 Modern Computing Techniques in Process Engineering
- ENEE 789C: Advanced topics in electrophysics: numerical methods in electromagnetism
- ENME 645, 646 Computational Fluid Dynamics and Heat Transfer I and II
- AOSC 614-625 Numerical Weather Forecasting & Data Assimilation
- AOSC 650 Neural Networks for the Physical Sciences
- AOSC 614 Atmospheric Modeling, Data Assimilation and Predictability
- STAT 705 Computational Statistics
- STAT 798C Computational Methods in Statistics
- CMSC 665 Scientific Computing III: Data-Driven and Machine Learning Methods
- CMSC 828D
- CMSC 848U Selected Topics in Information Processing; Modern Computational Speech and Audition

Optimization

- BMGT 831 Operations Research
- CMSC828G Advanced Topics in Information Processing; Systems for Machine Learning
- ENCH 737 Chemical Process Optimization
- ENME 610, 625 Engineering Optimization I and II
- AMSC 764 Advanced Numerical Optimization

Mathematical/Statistical Modeling in Sciences

- CMSC 701 Computational Genomics
- CMSC 720 Foundations in Deep Learning
- ENCE 630,730 Environmental and Water Resource Systems I and II
- ENCE 731 Advanced Ground Water Hydrology
- ENCH 753 Aerosols and Particulate Science
- ENCH 869 Advanced Computer-Aided Process Engineering
- ENEE 644: Computer-aided design of digital systems
- ENEE 694: Physics and simulation of semiconductor devices
- ENME 616 Computer-Aided Manufacturing
- ENSE 621 Systems Engineering Principles
- ENSE 622 System Modeling and Analysis
- GEOL 789C: Computational GeoScience: Data Handling and Analysis
- ZOOL 625 Mathematical Biology

Quantum Computing

- CMSC 657 Introduction to Quantum Information Processing
- CMSC 858G Quantum Error Correction and Fault-Tolerance
- CMSC 858Q Quantum Algorithms

Research Interaction Teams or RITs

Students in the Applied Statistics and Applied Mathematics tracks must take two approved one-credit seminar courses. One-credit seminar courses include:

- an approved RIT (AMSC 689);
- an appropriate seminar offered by Mathematics or another department.

Student-run seminars are not eligible to be used for this degree requirement.

To receive credit, the student is expected to attend the seminar regularly and to give at least one half-hour talk on an application of mathematics. If the student decides to take a seminar course in another department, he or she must have prior consent of the AMSC Director or submit a study plan (including the seminar course) for approval to the AMSC Graduate Committee. The faculty member in charge of the seminar must attest that the requirements listed above have been met.

Most RITs meet as informal seminars with active student participation. The following is a sample list of RITs previously offered:

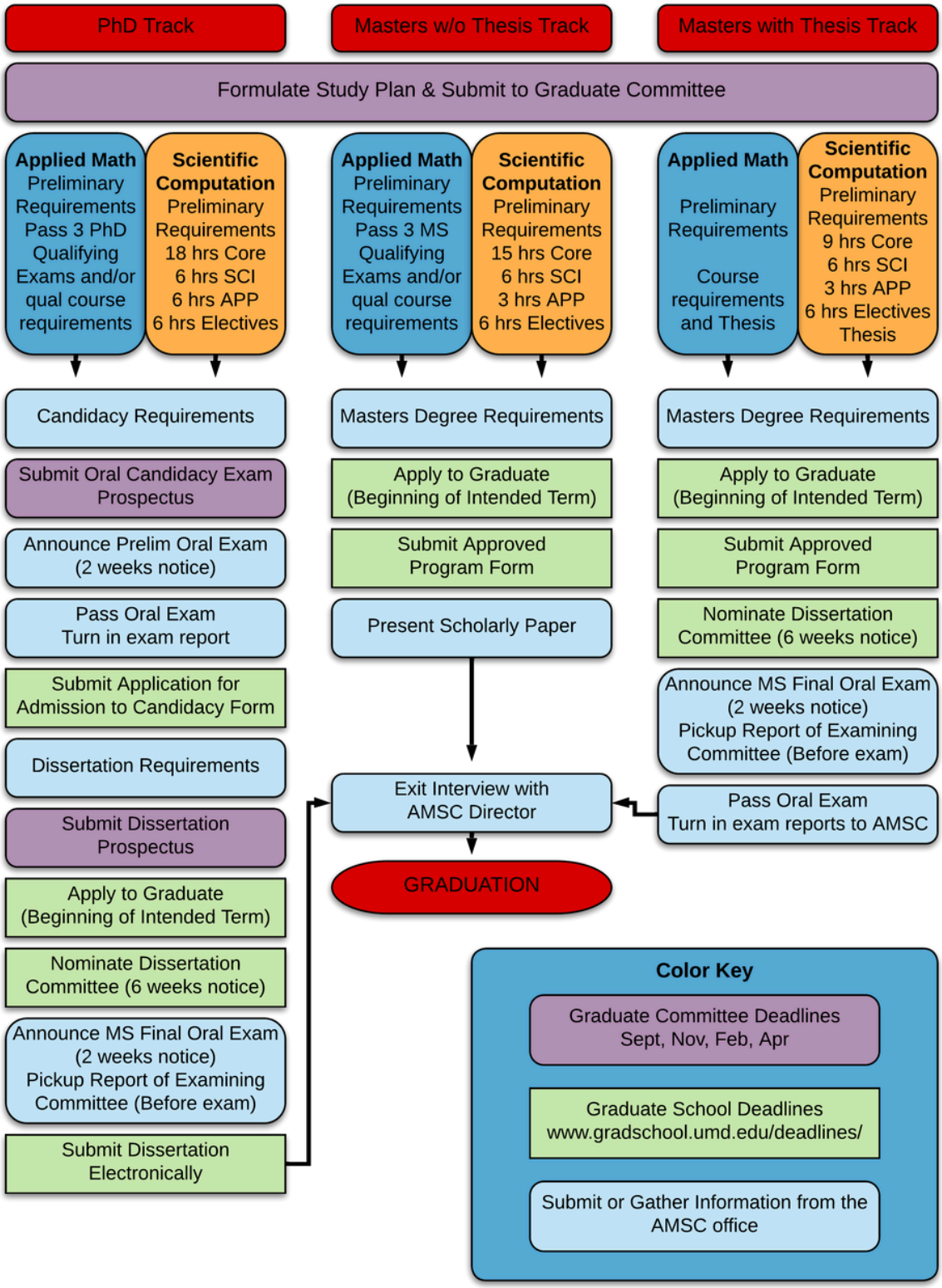
- RIT on Applied Partial Differential Equations
- RIT on Statistics
- RIT on Analysis of Complex Networks
- RIT on Advanced Elementary Number Theory
- RIT on Quantum Information
- RIT on Geometry and Physics
- RIT on Higgs Bundles
- RIT on Weather, Chaos, and Data Assimilation
- RIT on Financial Mathematics
- RIT on Computational Linguistics (aka CLIP Colloquium)
- Cancer Modeling RIT
- RIT on Optimization and Equilibrium Problems with Applications in Engineering
- RIT on Particle Systems
- RIT on Air Traffic Management
- RIT on Deep Learning

The list of RITs, including the organizers and meeting information can be found on this webpage: https://www-math.umd.edu/research/seminars/current-rits-and-student-seminars.html

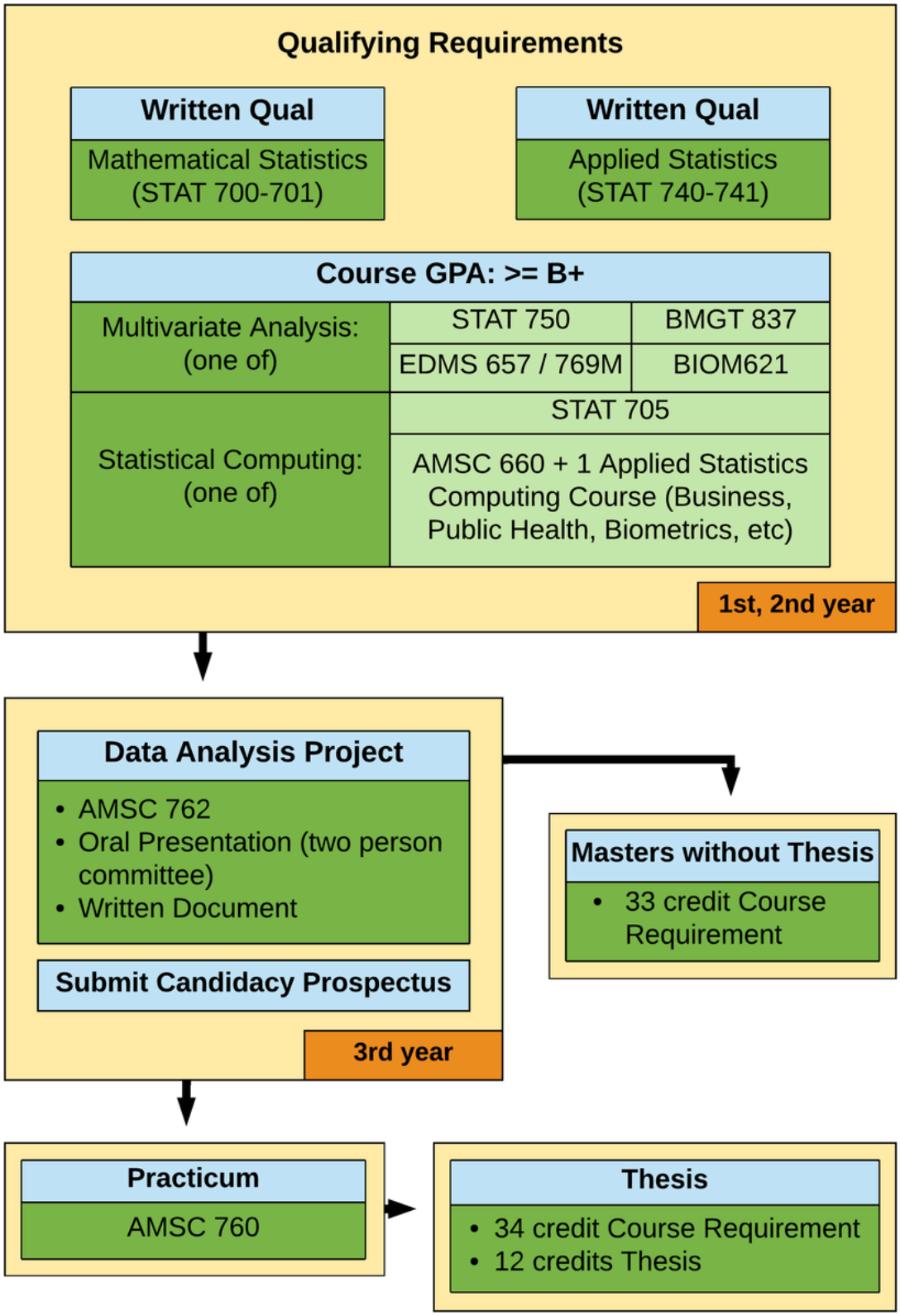
Students interested in getting credit for an RIT must secure an RIT faculty mentor. The RIT faculty mentor is often the RIT organizer, but it can also be the student's advisor or another faculty member who will regularly attend the RIT. The RIT faculty mentor will assign the grade, provide research guidance, and be present for the student's presentation.

Once an RIT faculty mentor is secured, the student should contact the AMSC Coordinator to be registered for credit for the RIT prior to or at the beginning of the semester.

Applied Mathematics & Scientific Computation Flowchart



Applied Statistics Flowchart



Registration Permission for Courses in Outside Departments

If you are interested in taking courses in departments outside of AMSC/MATH/STAT, you may need to secure permission first from those outside departments. The following are the contacts for some outside departments; you should email them directly if permission is required for their courses. Check the Schedule of Classes website to see if the course requires permission: https://app.testudo.umd.edu/soc/. If it requires the instructor's permission, contact the instructor via email first, then forward the instructor's approval to the contact below. You may need to get permission for courses in MATH/STAT/AMSC as well; in that case, forward the instructor's approval to the AMSC Coordinator.

Aerospace Engineering

Contact: Leslie Davis
Office: 3179 Glenn L. Martin Hall
Phone: 301-405-0190
Email: ldavis17@umd.edu

Astronomy

Contact: Olivia Dent
Office: 1208F Physical Sciences Complex
Phone: 301-405-1512
Email: odent@umd.edu

Atmospheric Science

Contact: Tammy Hendershot
Office: 3405 Atlantic Building
Phone: 301-405-5389
Email: tbarksda@umd.edu

Biology

Contact: Elizabeth Pepper
Office: 1247 Biology Psychology Building
Phone: 301-405-6905
Email: bisi@umd.edu

Business & Management

Contact: Mary Susan Forsythe
Office: 3330 Van Munching Hall
Phone: 301-405-1777
Email: mforsythe@rhsmith.umd.edu

Chemical & Biomolecular Engineering

Contact: Kathy Gardinier
Office: 2113E Chemical & Nuclear Engineering Building
Phone: 301-405-5888
Email: lopresti@umd.edu

Civil and Environmental Engineering

Contact: Anna L. Damm
Office: 0147B Glenn L. Martin Hall
Phone: 301-405-4195
Email: adamm1@umd.edu

Computer Science

Contact: Tom Hurst
Office: 1130 Brendan Iribe Center
Phone: 301-405-0771
Email: thurst@umd.edu

Economics

Contact: Vickie Fletcher
Office: 3114E Tydings Hall
Phone: 301-405-3544
Email: vfletche@umd.edu

Electrical & Computer Engineering

Contact: Emily Irwin
Office: 2435 A.V.Williams Building
Phone: 301-405-0680
Email: eirwin@umd.edu

Epidemiology & Biostatistics

Contact: Jamie Trevitt
Office: 2234G SPH Building
Phone: N/A
Email: jtrevitt@umd.edu

Geology

Contact: Michelle Montero
Office: 1117 Geology building
Phone: 301-405-4065
Email: mmontero@umd.edu

Mechanical Engineering

Contact: Kerri Poppler James
Office: 2180 Glenn L. Martin Hall
Phone: 301-405-8601
Email: Kjames3@umd.edu

Neuroscience (NACS)

Contact: Claire Morse
Office: 0218 Cole Student Activities Building
Phone: 301-405-5218
Email: cmorse@umd.edu

Physics

Contact: Josiland Chambers
Office: 1309D John S. Toll Physics Building
Phone: 301-405-5982
Email: jchamb@umd.edu