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## Advanced Graduate Certificates

To further strengthen your training and competitiveness in the job market, the AMS Department has 3 Advanced Graduate Certificates (AGC) available:

- (1) A 17-credit AGC on Data Science – can be taken by all AMS graduate students;
- (2) A 15-credit AGC on Quantitative Finance (QF) – can be taken by all AMS graduate students, except those in the QF track;
- (3) An 18-credit AGC on Operations Research (OR) – can be taken by all AMS graduate students except those in the OR track.

Since many courses shared by both your regular graduate program and the AGC can be doubly-counted in both, pursuing an AGC will incur only a limited number of extra courses one has to take. Therefore, it is a very cost-effective way to strengthen your skills and your resume – the key is to register for the certificate program as soon as possible.

### 1. Data Science & the Advanced Graduate Certificate in Data Science:

Data science has been gaining importance in the job market in the recent years, especially with explosion of data available in all sectors of the economy. “Data Scientist” has been voted the most satisfying job three years (2016, 2017, 2018) in a row, by glassdoor.com. Computing skills and data analysis are the two main pillars of data science. Adding to our rigorous data analysis training, we have strengthened your training in computing with several available courses designed to enhance your skills in algorithms and their implementations, in various programming languages. The following courses are the ones that we hope you can all master:

AMS 595 Fundamentals of Computing (matlab, Python, C++) – everyone should take this course, unless already very proficient in these topics

AMS 597 Statistical Computing (R, and a bit Perl) – this is also a core course in statistics

AMS 598 Big Data Analysis -- application of supercomputing to statistical data analysis, particularly on big data

AMS 530 Principles in Parallel Computing – this course is also closely related to big data analysis. We hope those of you who miss being able to take 598 will take 530.

### **Advanced Graduate Certificate in Data & Computational Science:**

Through IACS (<https://iacs.stonybrook.edu/opportunities/certificates/cdcs>), we have a 17-credit Graduate Certificate in Data and Computational Science available to AMS students, both MS and PhD. **The AGC Data Science requirement is summarized here:**

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- 17 credits, courses can be double counted toward the certificate and the student's major;
  - Three core courses: (1) JRN 501: Distilling Your Message, (2) JRN 503 Improvisation for Scientists, (3) AMS 561 Introduction to Computational and Data Science;
  - AMS students: at least 3 credits in CS (not crosslisted with AMS) and 3 credits in a non-AMS crosslisted course in any department from the course catalog ([cdcse-course-catalog-2.docx](#)).

**Here are some key pointers for AMS graduate students:**

- (1). For the core course AMS 561 -- we can replace it with AMS 595.
- (2). For the two Journalism (JRN) courses (1 credit each), they can be taken within one semester, or taken separately.
- (3). We can use 6 credits you have already earned before being registered to this certificate.
- (4). It is important to **register** for the certificate program **early** (\*definitely before your second Fall semester) because up to 12 credits can be counted towards both your AMS degree program and this certificate.
- (5). The key is that you need to take one 3-credit CS course (\*that is not cross-listed with AMS), plus another 3-credit course that is from ANY non-AMS department (CS, ECE, College of Business etc., not cross-listed with AMS)
- (6). **Once you have decided to pursue this certificate, please make an appointment to see Lynn at IACS ([Lynn.Allopenna@stonybrook.edu](mailto:Lynn.Allopenna@stonybrook.edu))**

For CS courses <https://www.cs.stonybrook.edu/students/Graduate-Studies/courses>, we think the following courses may be good options:

CSE505 Computing with Logic  
CSE512 Machine Learning  
CSE519 Data Science Fundamentals  
CSE525 Introduction to Robotics  
CSE532 Theory of Database Systems  
CSE544 Prob/Stat for Data Scientists  
CSE545 Big Data Analytics  
CSE549 Computational Biology  
CSE564 Visualization

Below are some sample course schedules for those who are interested in this

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certificate.

**A. For students in the CAM track:**

**First Semester (Fall)**

- **AMS 501** Differential Equations and Boundary Value Problems
- **AMS 510** Analytical Methods for Applied Mathematics and Statistics (Fall)
- **AMS 526** Numerical Analysis I (Numerical Linear Algebra)
- **AMS 595** Fundamentals of Computing (If not taking an ESL course)

**Second Semester (Spring)**

- **AMS 502** Differential Equations and Boundary Value Problems II (or choose another elective for Masters students)
- **AMS 527** Numerical Analysis II (Approximation Theory and Numerical ODEs)
- **AMS 528** Numerical Analysis III (Numerical PDEs)
- **CS graduate course**

**Third Semester (Fall)**

- **AMS 503** Applications of Complex Analysis
- **JRN 501 (1 credit)**
- **JRN 503 (1 credit)**
- **CS graduate course (or another non-AMS graduate course)**
- One AMS elective (e.g. AMS 530, AMS 542, AMS 562, AMS 565, etc.)

**B. For students in the CB track:**

**SEMESTER 1 - FALL**

AMS-510 (3 credits), Analytical Methods for Applied Mathematics and Statistics  
**CSE-549 (3 credits), Computational Biology (\*It can count towards the certificate)**  
AMS-535 (3 credits), Intro to Computational Structural Biology & Drug Design  
Elective (3 credits)  
AMS-531 (0/3 credits), Lab Rotations  
AMS-532 (0/1 credits), Journal Club  
AMS-539 (0/1 credits) Intro to Physical & Quantitative Biology

**SEMESTER 2 - SPRING**

AMS-533 (3 credits), Numerical Methods and Algorithms in Computational Biology  
AMS-537 (3 credits), Biological Networks and Dynamics  
Elective (3 credits)  
Elective (3 credits)  
AMS-531 (0/3 credits), Lab Rotations  
AMS-532 (0/1 credits), Journal Club (includes Responsible Conduct of Research)  
PHY-561 (1/3 credits) Introduction to Biology for Physical and Quantitative Scientists

**SEMESTER 3 - FALL**

AMS-507 (3 credits), Introduction to Probability

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CHE-541/MCB-520 (3 credits), Graduate Biochemistry

Elective (3 credits) \*\*\* Suggested elective PHY 558 Physical Biology (It can count towards the certificate too)

AMS 532 (0/1 credits), Journal Club

- [JRN 501 \(1 credit\)](#)
- [JRN 503 \(1 credit\)](#)

### C. For students in the OR track:

#### First Semester (Fall):

- AMS 507 Introduction to Probability
- AMS 510 Analytical Methods for Applied Mathematics and Statistics
- AMS 540 Linear Programming
- AMS 595 Fundamentals of Computing

#### Second Semester (Spring):

- AMS 550 Stochastic Models
- One Operations Research Elective
- One Statistics Elective
- [CS graduate course](#)

#### Third Semester (Fall):

AMS 553 Simulation and Modeling

- [JRN 501 \(1 credit\)](#)
- [JRN 503 \(1 credit\)](#)
- [CS graduate course \(or another non-AMS graduate course\)](#)
- One AMS elective (Operations Research)

### D. For students in the QF track:

For our domestic master's students and all doctoral students (domestic + international) in QF who wish to get the advanced graduate certificate in Data Science, you can follow the current QF course schedule for the first 3 semesters (<https://www.stonybrook.edu/commcms/ams/graduate/qf/index.php>), and then take the following courses in your fourth semester as the following:

#### Fourth Semester (Spring):

- [JRN 501 \(1 credit\)](#)
- [JRN 503 \(1 credit\)](#)
- [CS graduate course](#)
- [CS graduate course \(or another non-AMS graduate course\)](#)

For our international master's students in QF who wish to get the advanced graduate certificate in Data Science, you must hold one core course off until the fourth

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**semester** as the following sample course schedule shows:

**Typical Course Sequence for Master in Quantitative Finance Track- Big Data**

- First Semester: AMS 507, 510, 511, 595
- Second Semester: AMS 512, 513, 570, non-AMS graduate course
- Third Semester: AMS 514, 516, 530, 598
- **Fourth Semester:** AMS 542, CS graduate course, JRN 501 (1 credit), JRN 503 (1 credit), AMS\* 603 (1-credit) (\*Optional – with less than 9 credits one has to petition for part time student status – and so this helps make up 9 credits.)

**Note:** AMS 542 serves to replace AMS 517 as a core course

**Typical Course Sequence for Master in Quantitative Finance Track- Buy side**

- First Semester: AMS 507, 510, 511, 595
- Second Semester: AMS 512, 513, 522, non-AMS graduate course
- Third Semester: AMS 514, 516, 518, 572
- **Fourth Semester:** AMS 517, CS graduate course, JRN 501 (1 credit), JRN 503 (1 credit), AMS\* 603 (1-credit) (\*Optional – with less than 9 credits one has to petition for part time student status – and so this helps make up 9 credits.)

**Typical Course Sequence for Master in Quantitative Finance Track- Hedge Funds**

- First Semester: AMS 507, 510, 511, 595
- Second Semester: AMS 512, 513, 523, non-AMS graduate course
- Third Semester: AMS 514, 516, 518, 572
- **Fourth Semester:** AMS 517, CS graduate course, JRN 501 (1 credit), JRN 503 (1 credit), AMS\* 603 (1-credit) (\*Optional – with less than 9 credits one has to petition for part time student status – and so this helps make up 9 credits.)

**Typical Course Sequence for Master in Quantitative Finance Track- Sell side**

- First Semester: AMS 507, 510, 511, 526
- Second Semester: AMS 512, 513, 528, non-AMS graduate course
- Third Semester: AMS 514, 516, 595
- **Fourth Semester:** AMS 517, CS graduate course, JRN 501 (1 credit), JRN 503 (1 credit), AMS\* 603 (1-credit) (\*Optional – with less than 9 credits one has to petition for part time student status – and so this helps make up 9 credits.)

**E. For students in the STAT track:**

For our internal master's students in statistics who wish to get the advanced graduate certificate in Data Science, we recommend the following schedule (\*our domestic master's students and doctoral students can follow the same schedule except you can take AMS 597 <core course> first, and AMS 562 <elective> last):

(1) Year 1, Fall semester: AMS 507, AMS 510, AMS 572, AMS 595

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- (2) Year 1, Spring semester: AMS 570, AMS 573, AMS 578, AMS 562 (or AMS 530)
  - (3) Year 2, Fall semester: AMS 582, CS graduate course, AMS 588 (\*AMS 571 for doctoral students), AMS 598
  - (4) Year 2, Spring semester: JRN 501 (1 credit), JRN 503 (1 credit), AMS 597, CS graduate course (or another non-AMS graduate course), AMS 586 (or AMS 550)

For our master's students who are determined to graduate in 3 semesters, you can follow the schedule (35 credits in total) below:

- (1) Year 1, Fall semester: AMS 507, AMS 510, AMS 572, AMS 595 (12 credits)
- (2) Year 1, Spring semester: AMS 570, AMS 573, AMS 578, AMS 597 (12 credits)
- (3) Year 2, Fall semester: AMS 582, JRN 501 (1 credit), JRN 503 (1 credit), CS graduate course, CS graduate course (or another non-AMS graduate course) (11 credits)

If you wish to get this certificate, please follow the steps outlined in the IACS website:  
<https://iacs.stonybrook.edu/opportunities/certificates/cdcs>

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## 2. Advanced Graduate Certificate in Quantitative Finance (QF):

\*\* Given that the track of Statistics is highly correlated with the track of Quantitative Finance, interested students can choose to take selected courses in QF and obtain the 15-credit Advanced Graduate Certificate in Quantitative Finance introduced below.

Any strong student (3.5+ GPA in first-semester core courses) in another track (such as statistics) may enroll in AMS 511, Foundations in Quantitative Finance. You must formally apply for the secondary certificate program prior to taking the required courses. Only a maximum of six credits taken prior to enrolling in the certificate program may be used towards the requirements. The QF certificate requires **AMS 511, 512, 513**, one additional QF elective, and one additional AMS course.

**AMS 511 Foundations of Quantitative Finance**

**AMS 512 Portfolio Theory**

**AMS 513 Financial Derivatives and Stochastic Calculus**

**The form** to apply for the secondary certificate program (\*same as the one for the Data Science AGC – however one should just take one AGC, not more than one\*):

<http://grad.stonybrook.edu/data/documents/forms/newforms/Permission%20to%20Enroll%20in%20a%20Secondary%20Certificate%20Program.pdf>

**For our international master's students in statistics who wish to obtain the advanced graduate certificate in QF, we recommend the following schedule (\*our domestic master's students and doctoral students can follow the same schedule except you can take AMS 597 <core course> first, and AMS 586 <elective> last) – \*\*\* students in other tracks except for QF, can follow this example to customize your course plan \*\*\*:**

- (1) Year 1, Fall semester: **AMS 507, AMS 510, AMS 572**, AMS 595
- (2) Year 1, Spring semester: **AMS 570, AMS 573, AMS 578**, AMS 586 (or AMS 550, or AMS 562, etc.)
- (3) Year 2, Fall semester: **AMS 582, AMS 511**, AMS 588 (\*AMS 571 for doctoral students), AMS 598 (\*One must take 582 & 511 – however, to maintain full time status requiring 9 credits, you only need one more elective, so choose one from 588 and 598 and other graduate courses)
- (4) Year 2, Spring semester: **AMS 512, AMS 513, AMS 597**, (AMS 550 etc. – optional)

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### 3. Advanced Graduate Certificate in Operations Research (OR):

The department also has an 18-credit advanced graduate certificate in Operations Research (<http://www.stonybrook.edu/commcms/spd/graduate/operations.html>). Any student, except for those in the OR track, can apply for the AGC in OR.

This certificate has 5 REQUIRED COURSES (15 credits):

AMS 507 Introduction to Probability

**AMS 540 Linear Programming**

**AMS 550 Stochastic Models**

**AMS 553 Simulation and Modeling**

AMS 572 Data Analysis I

Plus one ELECTIVE (3 credits) which can be any graduate course in AMS, management and policy, or computer science, which has been approved by the student's advisor. While the other two AGCs will go through our Graduate School **permission to enroll in this certificate program will go through the School of Professional Development (SPD) as shown in the following link:**

<http://www.stonybrook.edu/commcms/spd/graduate/operations.html>