

# Mathematics Department

## Undergraduate Handbook 2018-2019

DEPARTMENT of MATHEMATICS, OREGON STATE UNIVERSITY  
CORVALLIS OR 97331-4605

### 1 OVERVIEW

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General information about Oregon State University is at [oregonstate.edu](http://oregonstate.edu)  
Information about the Mathematics Department is at [math.oregonstate.edu](http://math.oregonstate.edu)  
Mathematics undergraduate program information is at [math.oregonstate.edu/undergrad\\_programs](http://math.oregonstate.edu/undergrad_programs)  
Information about undergraduate advising in Mathematics as at [math.oregonstate.edu/undergrad\\_advising](http://math.oregonstate.edu/undergrad_advising)  
Mathematics Department office, Kidder 368, hours Monday through Friday from 9am to 5pm

### 2 INTRODUCTION

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The Department of Mathematics at OSU offers a Bachelor of Science degree in Mathematics, a minor in Mathematics, and a minor in actuarial science. The department also offers MA, MS, and PhD degrees at the graduate level.

The Bachelor of Science in Mathematics trains students to think logically and precisely, and exposes students to many areas of pure and applied Mathematics. In addition to the standard degree in Mathematics, students can also select from four transcript-visible options: Applied and Computational Mathematics, Mathematical Biology, Secondary Teaching Emphasis, or Statistics.

### 3 RESOURCES FOR STUDENTS

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#### 3.1: Early-Career Mathematics Advising:

For OSU students taking 100 or 200 level MTH courses, professional advisors **Sara Clark** and **Dave Wing** offer program and scheduling advice, registration PINs, and provide general assistance, such as signing change-of-major/minor forms and petitions.

To make an appointment, complete the form at [math.oregonstate.edu/request-advising-appointment](http://math.oregonstate.edu/request-advising-appointment)

Drop in advising hours are posted at [math.oregonstate.edu/undergrad\\_advising](http://math.oregonstate.edu/undergrad_advising)

#### 3.2: Upper-Division Mathematics Advising:

As Mathematics majors begin taking upper-division coursework in Mathematics, they transition to an advisor on the **Undergraduate Advising Committee**. These advisors provide individualized advice about our degree and options, monitor progress toward degrees and are a source for information on careers and graduate schools.

Students pursuing one of the four options should contact the option specific advisors listed at [math.oregonstate.edu/undergrad\\_advising](http://math.oregonstate.edu/undergrad_advising). For the 2018-2019 academic year, these are Dr. Nathan Gibson the Applied and Computational Mathematics Option and the Mathematical Biology Option, Dr. Mina Ossiander for the Statistics Option, and Dr. Tom Dick for the Secondary Teaching Emphasis Option. Any students interested in actuarial courses, exams, internship and career possibilities, or the minor program should contact Dr. Enrique Thomann.

Current members of the Advising Committee can be found at [math.oregonstate.edu/undergrad\\_advising](http://math.oregonstate.edu/undergrad_advising). To schedule a face-to-face advising appointment, complete the form at [math.oregonstate.edu/request-advising-appointment](http://math.oregonstate.edu/request-advising-appointment)

### 3.3: Mathematics & Statistics Learning Center:

The Mathematics & Statistics Learning Center (MSLC) is located on the first floor of Kidder Hall, room 108. The MSLC provides free drop-in tutoring, an open study area for students and study groups, reference books, make-up testing, and other services and resources.

Junior and senior math majors sometimes work as tutors in the MSLC, either as a work-study job or for credit. Math majors are encouraged to use the MSLC as a place to meet and study with each other. There is a computer lab adjoining the MSLC, which math majors are free to use unless a class is scheduled. The MSLC is open Monday through Thursday 9am to 5pm and Friday 9am to 4 pm.

## 4 DEGREE PROGRAMS

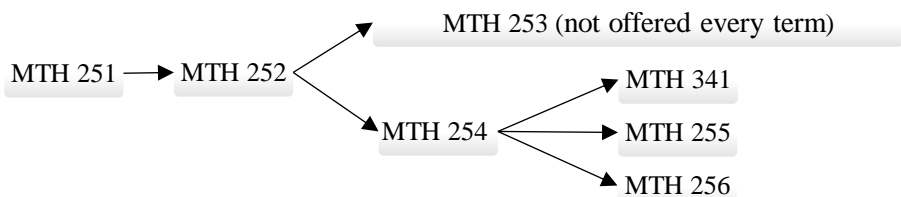
The Department of Mathematics offers a Bachelor of Science in Mathematics. Within the BS degree, students can also select options in Applied and Computational Mathematics, Mathematical Biology, a Secondary Teaching Emphasis, or Statistics. Also available are Minors in Mathematics and in Actuarial Science.

In addition to requirements in the major, OSU undergraduates are required to complete college and university level requirements as well as the Baccalaureate Core requirements, which is OSU's general education program. Students should track degree progress using the on-line MyDegrees program audit system. College of Science requirements include several required science courses that overlap with the major and Baccalaureate Core requirements. University degree requirements include at least 180 credits, including at least 60 upper division credits, and a residency requirement. The [OSU General Catalog](#) is the official source of all degree requirements. **Important: Your academic advisors are there to help you navigate degree requirements, but it is the student's sole responsibility to ensure that all requirements are met.**

### 4.1: The Major Degree Program in Mathematics

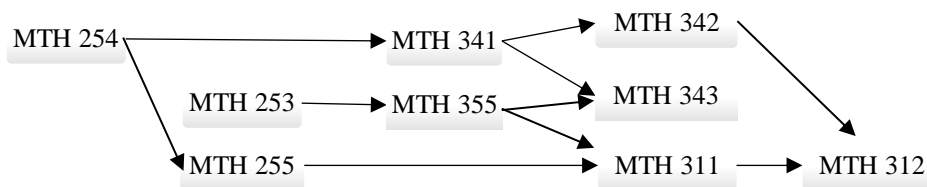
Regardless of option, all math majors must complete the junior level core courses in Mathematics. The required lower division Mathematics courses (those numbered less than 300), as well as MTH 341, are prerequisite to almost all 300-level courses. The junior core requirements total 27 credits. Some of the courses required for the math major will simultaneously satisfy Baccalaureate Core requirements.

A student who does not place directly into the calculus sequence in their first term can usually still complete the lower division courses during the first two years, as some courses in the calculus sequence can be taken simultaneously. A prerequisite flow chart is shown below:



The **Junior Core** consists of seven courses that all math majors must complete. These MTH courses are: 341, 342, 343, 355, 311, 312, plus one of the Writing Intensive Courses (WICs): MTH 323, 333, or 338. For their WIC, students in the Applied and Computational Mathematics Option must take MTH 323 and those with the Secondary Teaching Emphasis must take MTH 338. Additionally, MTH 323 is the preferred (but not required) WIC for the Mathematical Biology

Option and the Statistics Option. All Junior Core courses are listed on the checklists at the end of this pamphlet. A prerequisite flow chart is shown below:



A term-by-term scheduling overview of the availability of these courses for the current academic year can be found on the Math Department webpage at [math.oregonstate.edu/node/14789](http://math.oregonstate.edu/node/14789). The annual schedule is updated each year and students should stay in touch with advisors for long-term course planning.

## 4.2: Bachelor of Science in Mathematics and Options

Math majors can pursue the standard degree or choose one of four specialized, transcript-visible options within the degree program. All Math majors must complete the same lower-division Mathematics and Junior Core coursework. *A grade of at least C– and a GPA of 2.25 are required in all upper-division Mathematics courses used to fulfill degree requirements. An OSU GPA of 2.00 is required by the College of Science. No course used to fulfill requirements for your major may be taken “S/U.”*

### 4.2.1: The Standard Degree path

The BS degree in Mathematics requires a common core of courses at the lower-division level and junior-level followed by senior-level depth and breadth requirements. The depth and breadth requirements are designed to ensure that Math majors gain breadth of knowledge across diverse areas in Mathematics together with depth in some chosen area. The upper-division requirements in the major total 45–50 credits. Thus, Mathematics majors have ample opportunity to take further Mathematics courses or complementary programs of study focused toward specific interests and career goals. Programs supporting interdisciplinary interests are strongly encouraged. The detailed checklist of the requirements for the BS in Mathematics is on pages 6 and 7 of this pamphlet.

### 4.2.2: The Applied and Computational Mathematics Option

The Applied and Computational Mathematics Option offers a curriculum focusing on the mathematical tools and computational skills used in applying mathematics across the sciences. It is designed to allow students to concentrate much of their upper-division coursework on applied mathematics, modeling, and computation. Coursework for this option prepares students for careers in industry or at government labs, or, alternatively, for graduate school in mathematics, applied mathematics, and engineering. The detailed checklist of the requirements for the Applied and Computational Mathematics Option is on pages 8 and 9 of this pamphlet.

### 4.2.3: The Mathematical Biology Option

The Mathematical Biology option will teach students how to use Mathematics to solve problems in the biological sciences. This specialization will equip students for jobs in the biotech, pharmaceutical, and related industries as well as research institutes. In addition to the usual required lower-division Mathematics courses and the junior core courses, Mathematics majors in the Mathematical Biology option have an opportunity to concentrate much of their further course work on applied Mathematics, Mathematical biology, modeling and computation. The detailed checklist of the requirements for the Mathematical Biology option is on pages 10 and 11 of this pamphlet.

### 4.2.4: The Secondary Teaching Emphasis Option

Majors who plan to teach Mathematics in middle or high school may earn a transcript-visible option in education. The Secondary Teaching Emphasis option provides necessary Mathematics background and prerequisites for subsequent certification to teach math and science at the secondary level. Future teachers are also required to take two courses in math education that will help prepare them for a graduate program in education and teacher licensure. Students in this option who would like a stronger background in Mathematics are encouraged to take some of the senior level core math courses as electives. A detailed checklist for this option is included on page 12.

#### 4.2.5: The Statistics Option

The Statistics Option offers Mathematics majors an opportunity to concentrate their senior level course work on statistics and probability. It is designed to allow a focus on the study of the mathematical theory underlying statistics while simultaneously developing expertise in statistical applications. The Statistics Option provides excellent preparation for a career in data analysis or for graduate study in statistics and probability. A detailed checklist of the requirements for the Statistics Option is included on pages 13 and 14.

### 4.3: Accelerated Master's Platform

The [Accelerated Master's Platform](#) (AMP) in Mathematics allows current OSU Mathematics majors to take graduate classes in Mathematics, apply those credits to their current undergraduate degree, and transfer them to the OSU Mathematics graduate program. Up to twelve graduate credits will both count towards a bachelor's degree and transfer to the Mathematics Master's degree program. With careful planning, students could complete a Master's degree within one year of finishing their Bachelor's degree. Students apply for admission to the AMP during the Spring term of the junior year of study; admission is competitive. For more detailed information about the AMP in Mathematics can be found on the Mathematics department web site: [math.oregonstate.edu/amp](http://math.oregonstate.edu/amp)

### 4.4: Minor Degree Programs in Mathematics

The Department of Mathematics at Oregon State offers a minor in Mathematics and a minor in Actuarial Science. The minor in Actuarial Science allows students to take courses of interest to the financial and actuarial industries and helps students prepare for the first examination administered by the Society of Actuaries. For more information about this program is available under [Actuarial Science](#) on the departmental website. You may also send a message to [ActuarialInfo@math.oregonstate.edu](mailto:ActuarialInfo@math.oregonstate.edu). A very informative website about the actuarial profession is [beanactuary.org](http://beanactuary.org).

Requirements for both minor programs are described on page 15 of this pamphlet where a checklist for the Actuarial Science is included. Further information about both minor programs can be found under [Undergraduate Programs](#) on the Department of Mathematics website and by writing to [MathHeadAdvisor@math.oregonstate.edu](mailto:MathHeadAdvisor@math.oregonstate.edu).

## 5 OPPORTUNITIES IN MATHEMATICS

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See the [Undergraduate Resources](#) web page for additional information about these and other opportunities for Math majors: [math.oregonstate.edu/major\\_resource](http://math.oregonstate.edu/major_resource).

**Study Abroad:** OSU GO provides over 200 international opportunities for education, internships and research in more than 70 different countries around the world. To develop a strategy for your program search and better navigate the options available to you, check out their [Get Started](#) page. Read on to explore various study abroad program models available to you or follow the link below to search through our wide range of OSU-supported study abroad programs.

Other programs focus on a specific academic discipline and restrict participation to students in the associated department. These include the [Budapest Semesters in Mathematics](#) and the Budapest Semesters in Mathematics Education. Classes are taught in English by eminent Hungarian professors, most of whom have had teaching experience in North American universities. Course offerings combine standard upper-level courses with courses in areas of traditional strength of Hungarian Mathematics, such as combinatorics, number theory, and probability theory. Please talk to a math advisor if you are considering participating in an external study program. We want to make sure you have the prerequisites for math courses there and to determine, in advance, which courses will transfer to OSU on your return.

**Undergraduate Research:** Students should investigate research opportunities with individual faculty members at OSU. Also, the federal government funds many programs where undergraduates can study Mathematics and other sciences. Among these are the REU programs (Research Experiences for Undergraduates), usually offered for 8 to 10

weeks in the summer. Here is [a list](#) of current REUs in Mathematics. Oregon State has had an [REU in Mathematics](#) for over twenty-five years. A successful applicant has usually completed several courses that are similar to our 300-level courses in analysis or algebra, but that is not always the case. (Additional opportunities are available through the College of Science [science.oregonstate.edu/node/111](http://science.oregonstate.edu/node/111) and the OSU Research Office [research.oregonstate.edu/resources-undergraduate-research](http://research.oregonstate.edu/resources-undergraduate-research).)

**Jobs in Mathematics:** A degree in Mathematics can lead to a variety of careers, and the more Mathematics you learn the more doors are open to you. The website [CareerCast.com](http://CareerCast.com) ranks the "best jobs" each year in terms of total worker experience. In 2017, four of the top ten jobs are built on math, with statistician being ranked number one. Recent Oregon State Mathematics graduates work as insurance managers, actuaries, research biomathematicians, computer scientists, electrical engineers and robotics experts, just to name a few. For more information about job opportunities, visit the Mathematics department web site at: [math.oregonstate.edu/undergrad\\_careers](http://math.oregonstate.edu/undergrad_careers)

## 6 MATHEMATICS STUDENT ORGANIZATIONS

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There are a wide variety of student clubs and organizations and all interested students are welcome.

**Math Club:** The purpose of the Math Club is to provide opportunities for math enthusiasts to meet and explore their common interests. The Math Club is a primarily student run club, and it facilitates both fun and helpful math-related activities throughout the year, including social events, game nights, and study sessions. We'd love to have you join the club and share in our excitement about all things math-related! For more information about being a part of the Math Club, email the faculty advisor at [mathclub@math.oregonstate.edu](mailto:mathclub@math.oregonstate.edu).

**The Association for Women in Mathematics:** AWM, is a collection of students who share a common interest in the advancement of women in Mathematics. AWM hosts movie nights and pizza parties. They recently organized Sonia Kovalevsky Day at OSU, an event for local high-school and middle-school students which features math competitions, workshops, and lectures. If you are interested in learning more about AWM, please e-mail the current AWM officers at [awm@math.oregonstate.edu](mailto:awm@math.oregonstate.edu).

**The Society for Industrial and Applied Mathematics:** SIAM is a club, advised by a faculty member, for students interested in applied Mathematics and its and applications to industry. The group often hosts speakers from industry, holds tutorials, and organizes social events. If you are interested in learning more about SIAM, please e-mail the current SIAM officers at [siam@math.oregonstate.edu](mailto:siam@math.oregonstate.edu).

**Actuarial Science Club:** The ASC tries to promote awareness of the actuarial profession, disseminate information about the actuarial preparatory track and share information regarding actuarial coursework and exams, and internship and job opportunities. We invite speakers from the actuarial community to talk to students about various types of work they do, how they became an actuary, and what future trends they see in the profession. We meet two to three times per term. One of them tends to be a social gathering. Interested students can email [actuarialclub@math.oregonstate.edu](mailto:actuarialclub@math.oregonstate.edu).

**Pi Mu Epsilon (National Mathematics Honor Society), Oregon Beta Chapter:** PME is a non-secret honor society whose purpose is the promotion and recognition of scholarly activity in the mathematical sciences among students at the academic institutions that have been chartered as Chapters of the Society. If you would like to learn more about Pi Mu Epsilon please email [pme@math.oregonstate.edu](mailto:pme@math.oregonstate.edu).

# 7 CHECKLISTS FOR MATHEMATICS DEGREES

## 7.1 Checklist for the Bachelor of Science in Mathematics Standard Degree

The requirements for the math major portion of the Bachelor of Science in Mathematics are summarized below. The OSU General Catalog has the official listing at:

<https://catalog.oregonstate.edu/college-departments/science/mathematics/mathematics-bs-hbs/>

**NOTE:** The requirements for the standard BS in Mathematics were updated in 2015. Students who became Math majors during or after Spring 2015 need to satisfy the following requirements. Math majors declared before Spring 2015 are subject to the old requirements (given in MyDegrees and in the archived handbook) unless they intentionally choose to switch to the new requirements. Students wishing to switch requirements should visit their academic advisor.

### Lower Division Requirements:

- MTH 251 - 256                      The Calculus Sequence (MTH 251, 252, 253, 254, 255, 256)
- Physics 211                         General Physics with Calculus

### Upper Division Requirements:

**Part A: Junior Core** - All the following courses are required.

- MTH 355                              Discrete Mathematics
- MTH 311                              Advanced Calculus I
- MTH 312                              Advanced Calculus II
- MTH 341                              Linear Algebra I
- MTH 342                              Linear Algebra II
- MTH 343                              Introduction to Modern Algebra
- WIC<sup>1</sup>                                 MTH 323 Mathematical Modeling **or**  
MTH 333 Fundamental Concepts of Topology **or**  
MTH 338 Non-Euclidean Geometry

### Part B: Computational Requirement:

One course from the following list is required (NOTE: this course may also be used for Part C or Part D)

- |       |         |  |
|-------|---------|--|
| _____ | MTH 321 | Introductory Applications of Math Software |
| _____ | MTH 351 | Introduction to Numerical Analysis         |
| _____ | MTH 440 | Computational Number Theory                |
| _____ | MTH 441 | Applied and Computational Algebra          |
| _____ | MTH 451 | Numerical Linear Algebra                   |
| _____ | MTH 452 | Numerical Solution of ODE                  |

### Part C: Area Coursework

Upper division Mathematics coursework is offered in 6 distinct areas, all listed on the next page. The standard Math degree includes a Depth requirement (2 courses from one of the six areas) and a Breadth requirement (1 additional course from each of 3 of the remaining 5 areas). Some exceptions are noted.

Breadth courses:

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_

Area of Depth: \_\_\_\_\_

Depth courses in area:

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

**Note: Area Coursework and Part D Electives are listed on page**

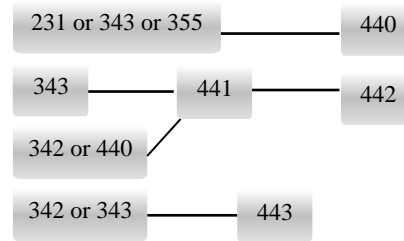
<sup>1</sup> Writing Intensive Course, a component of the Baccalaureate Core.

**Areas and Courses:** Most of these courses are offered just once per year. See [math.oregonstate.edu/node/14789](http://math.oregonstate.edu/node/14789) for scheduling information.

Algebra and Number Theory

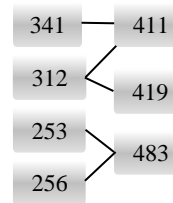
*(MTH 443 cannot be used in a pair to satisfy the Depth Requirement.)*

MTH 440	Computational Number Theory (3)
MTH 441	Applied and Computational Algebra (3)
MTH 442	Applied and Computational Algebra (3)
MTH 443	Abstract Linear Algebra (3)



Analysis

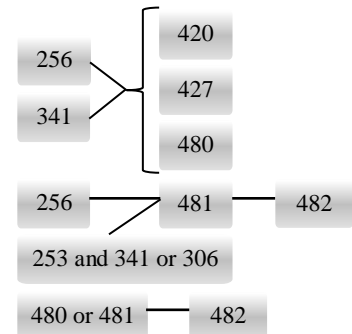
MTH 411	Real Analysis (3)
MTH 419	Multivariable Advanced Calculus (3)
MTH 483	Complex Variables (3)



Applied Mathematics

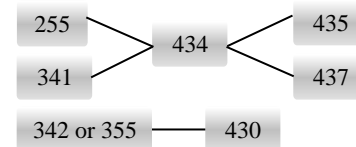
*(MTH 480 and MTH 481 cannot both be used to satisfy program requirements.)*

MTH 420	Models and Methods of Applied Mathematics (3)
MTH 427	Introduction to Mathematical Biology (3)
MTH 480	Systems of Ordinary Differential Equations (3)
MTH 481	Applied Ordinary Differential Equations (3)
MTH 482	Applied Partial Differential Equations (3) (480 or 481)



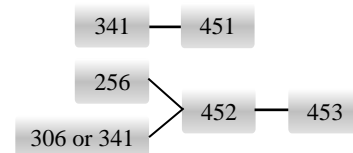
Geometry and Topology

MTH 430	Metric Spaces and Topology (3)
MTH 434	Introduction to Differential Geometry (3)
MTH 435 (Alternate Yrs.)	Differential Geometry (3)
MTH 437 (Alternate Yrs.)	General Relativity (3)



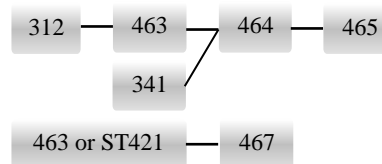
Numerical Analysis

MTH 451	Numerical Linear Algebra (3)
MTH 452	Numerical Solution of Ordinary Differential Equations (3)
MTH 453	Numerical Solution of Partial Differential Equations (3)



Probability

MTH 463	Probability I (3)
MTH 464	Probability II (3)
MTH 465	Probability III (3)
MTH 467	Actuarial Mathematics (3)



**Part D: Electives**

Two additional upper division elective courses of a mathematical nature are required. These can be upper division courses in Mathematics and Statistics (except for MTH 390 or blanket courses) or other courses of a mathematical nature approved by the departmental head advisor.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

## 7.2 Checklist for the Bachelor of Science in Mathematics with the Applied and Computational Mathematics Option

The requirements for the Applied and Computational option of the math major are summarized below. The OSU General Catalog has the official listing at:

<https://catalog.oregonstate.edu/college-departments/science/mathematics/#programstext>

### Lower Division:

- MTH 251 - 256      The Calculus Sequence (MTH 251, 252, 253, 254, 255, 256)
- Physics 211              General Physics with Calculus

### Upper Division

Upper division requirements for the A&CM Option are grouped into Parts A, B, C, and D. Part A is the junior core, Part B is the Applied and Computational Math core, Part C is the probability or statistics requirement, and Part D is mathematical sciences electives.

#### Part A: Junior Core

All the following courses are required.

- MTH 355              Discrete Mathematics
- MTH 311              Advanced Calculus I
- MTH 312              Advanced Calculus II
- MTH 341              Linear Algebra I
- MTH 342              Linear Algebra II
- MTH 343              Introduction to Modern Algebra
- WIC<sup>2</sup>                  MTH 323 Mathematical Modeling
- MTH 483              Complex Variables

Recommended (not required): An introduction to programming, computer algebra etc. such as MTH 351 Introduction to Numerical Analysis. (This course can be used to satisfy Part D requirements.)

#### Part B: Applied and Computational Core

5 of the following 9 courses are required. Either MTH 453 or MTH 482 must be included.

Also note that only one of MTH 480 and MTH 481 can be used to satisfy requirements for a degree in Mathematics.

- 1 \_\_\_\_\_              MTH 420      Models and Methods of Applied Mathematics
- 2 \_\_\_\_\_              MTH 440      Computational Number Theory
- 3 \_\_\_\_\_              MTH 441      Applied and Computational Algebra
- 4 \_\_\_\_\_              MTH 451      Numerical Linear Algebra
- 5 \_\_\_\_\_              MTH 452      Numerical Solution of Ordinary Differential Equations
- MTH 453      Numerical Solution of Partial Differential Equations
- MTH 480      Systems of Ordinary Differential Equations
- MTH 481      Applied Ordinary Differential Equations
- MTH 482      Applied Partial Differential Equations

**Parts C and D are on the following page.**

<sup>2</sup> Writing Intensive Course, a component of the Baccalaureate Core.



**Part C: Probability or Statistics requirement**

One of the following four courses is required:

- |           |         |   |
|-----------|---------|---|
| □ 1 _____ | MTH 361 | Introduction to Probability             |
|           | MTH 463 | Probability I                           |
|           | ST 351  | Introduction to Statistical Methods     |
|           | ST 421  | Introduction to Mathematical Statistics |

Note: ST 411 is an approved substitution for ST 351.

**Part D: Electives**

Two additional upper division elective courses of a mathematical nature are required. These can be upper division courses in Mathematics and Statistics (except for MTH 390 or blanket courses) or other courses of a mathematical nature approved by the departmental head advisor. Students may also satisfy this requirement by completing a two-term thesis project with a graduate faculty member. (The thesis project must be approved in advance by the supervising faculty member and the departmental head advisor.)

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

**Note:** A term-by-term scheduling overview of the availability of these courses for the academic year can be found on the Math Department webpage at [math.oregonstate.edu/node/14789](http://math.oregonstate.edu/node/14789).

## 7.3 Checklist for the Bachelor of Science in Mathematics with the Mathematical Biology Option

The requirements for the Mathematical Biology option of the math major are summarized below. The OSU General Catalog has the official listing at:

<https://catalog.oregonstate.edu/college-departments/science/mathematics/#programstext>

**Lower Division:** Note that these courses will also fulfill the College of Science degree requirements

- ☐ MTH 251 - 256                      The Calculus Sequence (MTH 251, 252, 253, 254, 255, 256)
- ☐ BI 211 - 213                        Principles of Biology (BI 211, 212, 213)
- ☐ CH 231 **and** CH 261              General Chemistry **and** Laboratory for Chemistry 231

### Upper Division

#### Part A: Junior Core

All the following courses are required.

- ☐ MTH 355                              Discrete Mathematics
- ☐ MTH 311                              Advanced Calculus I
- ☐ MTH 312                              Advanced Calculus II
- ☐ MTH 341                              Linear Algebra I
- ☐ MTH 342                              Linear Algebra II
- ☐ MTH 343                              Introduction to Modern Algebra
- ☐ WIC<sup>3</sup>                                  MTH 323 Mathematical Modeling **or**  
MTH 333 Fundamental Concepts of Topology **or**  
MTH 338 Non-Euclidean Geometry

#### Part B: Required Area Course Work in Mathematics and Statistics

All the following courses are required.

- ☐ MTH 427                              Introduction to Mathematical Biology
- ☐ MTH 428                              Stochastic Elements in Mathematical Biology
- ☐ MTH 463                              Probability I
- ☐ MTH 480                              Systems of Ordinary Differential Equations
- ☐ One of the following courses is required:
  - ST 351                                  Introduction to Statistical Methods **or**
  - ST 411                                  Methods of Data Analysis

#### Part C: Directed Electives are listed on the following page

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<sup>3</sup> Writing Intensive Course, a component of the Baccalaureate Core.

### Part C: Directed Electives

- One of the following two courses is required:
  - MTH 483                      Complex Variables
  - MTH 430                      Metric Spaces and Topology
  
- One of the following five courses is required:
  - MTH 420                      Models and Methods of Applied Mathematics
  - MTH 440                      Computational Number Theory
  - MTH 441                      Applied and Computational Algebra
  - MTH 464                      Probability II
  - MTH 482                      Applied Partial Differential Equations
  
- One of the following three courses is required:
  - MTH 351                      Introduction to Numerical Analysis
  - MTH 451                      Numerical Linear Algebra
  - MTH 452                      Numerical Solution of Ordinary Differential Equations
  
- One of the following nine courses, or another upper-division life science course approved by a Mathematics advisor, is required:
  - BI 311                          Genetics
  - BI 351                          Marine Ecology
  - BI 370                          Ecology
  - BI 445                          Evolution
  - BOT 341                      Plant Ecology
  - BOT 442                      Plant Population Ecology
  - BOT 476                      Introduction to Computing in the Life Sciences
  - CS 446                          Biological Networks
  - FW 320                          Introductory Population Dynamics

**Note:** A term-by-term scheduling overview of the availability of these courses for the academic year can be found on the Math Department webpage at [math.oregonstate.edu/node/14789](http://math.oregonstate.edu/node/14789).

## 7.4 Checklist for the Bachelor of Science in Mathematics with Secondary Teaching Emphasis Option

The requirements for the Secondary Teaching option of the math major are summarized below. The OSU General Catalog has the official listing at:

<https://catalog.oregonstate.edu/college-departments/science/mathematics/#programstext>

### Lower Division:

- ☐ MTH 251 – 256                      The Calculus Sequence (MTH 251, 252, 253, 254, 255, 256)
- ☐ Physics 211                              General Physics with Calculus

### Upper Division<sup>4</sup>

- ☐ MTH 355                              Discrete Mathematics
- ☐ MTH 311                              Advanced Calculus I
- ☐ MTH 312                              Advanced Calculus II
- ☐ MTH 341                              Linear Algebra I
- ☐ MTH 342                              Linear Algebra II
- ☐ MTH 343                              Introduction to Modern Algebra
- ☐ MTH 338                              Non-Euclidean Geometry, a WIC<sup>5</sup>
- ☐ ED 309                                Field Practicum (3 credits)
- ☐ SED 414                                Inquiry in Mathematics and Mathematics Education
- ☐ MTH 361                                Introduction to Probability (MTH 463 can be substituted)
- ☐ ST 351                                 Introduction to Statistical Methods (ST 421 can be substituted)
- ☐ MTH 491                                Algebraic and Geometric Transformations
- ☐ MTH 492                                Algebraic and Geometric Transformations
- ☐ MTH 493                                Algebraic and Geometric Transformations

**Note:** Students wanting a stronger background in statistics may substitute ST 421 for ST 351. Students wanting a stronger background in probability may substitute MTH 463, Probability I, (usually taken in the senior year) for MTH 361.

**Note:** A term-by-term scheduling overview of the availability of these courses for the academic year can be found on the Math Department webpage at [math.oregonstate.edu/node/14789](http://math.oregonstate.edu/node/14789).

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<sup>4</sup> Students who want a stronger background in Mathematics should choose some courses from the seven senior directed electives listed in the Mathematics major.

<sup>5</sup> Writing Intensive Course, a component of the Baccalaureate Core.

## 7.5 Checklist for the Bachelor of Science in Mathematics with the Statistics Option

The requirements for the Statistics option of the math major are summarized below. The OSU General Catalog has the official listing at:

<https://catalog.oregonstate.edu/college-departments/science/mathematics/#programstext>

### Lower Division:

- MTH 251 - 256                 The Calculus Sequence (MTH 251, 252, 253, 254, 255, 256)
- Physics 211                     General Physics with Calculus
- Recommended:                 ST 201 Principles of Statistics **or**  
  ST 351 Intro to Statistical Methods

### Upper Division:

Upper division requirements for the Statistics Option are grouped into Parts A, B, C, and D. Part A is the junior core, Part B is composed of the probability and statistics core classes, Part C is an option specific depth requirement, and Part D is a breadth requirement in mathematics.

**Part A: Junior core.** All the following courses are required.

- MTH 355                         Discrete Mathematics
- MTH 311                         Advanced Calculus I
- MTH 312                         Advanced Calculus II
- MTH 341                         Linear Algebra I
- MTH 342                         Linear Algebra II
- MTH 343                         Introduction to Modern Algebra
- WIC<sup>6</sup>                             MTH 323 Mathematical Modeling (preferred) **or**  
  MTH 333 Fundamental Concepts of Topology **or**  
  MTH 338 Non-Euclidean Geometry

**Part B: Mathematics and Statistics advanced core.** All the following courses are required.

- MTH 463                         Probability I
- MTH 464                         Probability II
- ST 411                             Methods of Data Analysis
- ST 412                             Methods of Data Analysis
- ST 421                             Introduction to Mathematical Statistics
- ST 422                             Introduction to Mathematical Statistics

**Part C: Depth in Option.**

One of the following courses is required.

- |                                  |         |  |
|----------------------------------|---------|--|
| <input type="checkbox"/> 1 _____ | MTH 465 | Probability III                                      |
|                                  | MTH 467 | Actuarial Mathematics                                |
|                                  | ST 413  | Methods of Data Analysis                             |
|                                  | ST 415  | Design and Analysis of Planned Experiments           |
|                                  | ST 431  | Sampling Methods                                     |
|                                  | ST 439  | Survey Methods                                       |
|                                  | ST 441  | Probability, Computing, and Simulation in Statistics |
|                                  | ST 443  | Applied Stochastic Models                            |

**Part D is on the following page**

<sup>6</sup> Writing Intensive Course, a component of the Baccalaureate Core.

### Part D: Breadth in Mathematics

One course from each of 2 of the following 5 areas is required.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

MTH 321, Introductory Applications of Mathematical Software, can be substituted for one of the breadth courses.

#### Algebra and Number Theory:

MTH 440	Computational Number Theory
MTH 441	Applied and Computational Algebra

#### Analysis:

MTH 411	Real Analysis
MTH 483	Complex Variables

#### Applied Mathematics:

MTH 420	Models and Methods of Applied Mathematics
MTH 427	Introduction to Mathematical Biology
MTH 480	Systems of Ordinary Differential Equations
MTH 481	Applied Ordinary Differential Equations

#### Geometry and Topology

MTH 430	Metric Spaces and Topology
MTH 434	Introduction to Differential Geometry

#### Numerical Analysis

MTH 351	Introduction to Numerical Analysis
MTH 451	Numerical Linear Algebra
MTH 452	Numerical Solution of Ordinary Differential Equations

**Note:** A term-by-term scheduling overview of the availability of these courses for the academic year can be found on the Math Department webpage at [math.oregonstate.edu/node/14789](http://math.oregonstate.edu/node/14789).

An overview of the availability of statistics coursework can be found on the Statistics Department webpage; see [stat.oregonstate.edu/content/yearly-courses](http://stat.oregonstate.edu/content/yearly-courses) for the listing of courses offered annually and [stat.oregonstate.edu/content/alternate-year-courses](http://stat.oregonstate.edu/content/alternate-year-courses) for alternate year courses.

## 8 CHECKLISTS FOR MINOR PROGRAMS IN MATHEMATICS

### 8.1 Minor in Mathematics

The requirements for a minor in Mathematics are 30 credits of MTH courses numbered 231 or higher, including 15 credits numbered 311 or higher. Either MTH 311 or MTH 341 must be included. MTH 390 may not be used for credit in the Mathematics minor. MTH 251, MTH 252 and MTH 254 are strongly recommended for students pursuing a minor in Mathematics. No course used to fulfill requirements for the minor in Mathematics may be taken "S/U." A minimum GPA of 2.0 is required in this minor. The official listing of requirements is in the OSU General Catalog at:

<https://catalog.oregonstate.edu/college-departments/science/mathematics/#programstext>

### 8.2 Minor in Actuarial Science

28 credits are required for the minor in actuarial science. These credits are fulfilled by the courses in the checklist below. A minimum GPA of 2.0 is required in this minor. No course used to fulfill requirements for the minor in actuarial science may be taken "S/U". The official listing of requirements is in the OSU General Catalog at:

<https://catalog.oregonstate.edu/college-departments/science/mathematics/#programstext>

**Important:** The following "no double-dipping" restriction applies to courses used for the minor in Actuarial Science: No upper-division courses other than MTH 306 and MTH 341 used to satisfy requirements in a student's major or additional minor program may also be used to satisfy the requirements of the actuarial science minor.

- MTH 251            Differential Calculus
- MTH 252            Integral Calculus
- MTH 253            Infinite Series and Sequences<sup>7</sup>
- MTH 254            Vector Calculus I
- MTH 341            Linear Algebra
- MTH 361            Introduction to Probability

#### **2 (or more) courses from the following list**

- 1 \_\_\_\_\_      MTH 351      Introduction to Numerical Analysis
- 2 \_\_\_\_\_      MTH 463      Probability I
- MTH 464      Probability II
- MTH 465      Probability III
- MTH 467      Actuarial Mathematics
- ST 411        Methods of Data Analysis
- ST 412        Methods of Data Analysis
- ST 413        Methods of Data Analysis
- ST 421        Introduction to Mathematical Statistics
- ST 422        Introduction to Mathematical Statistics
- ST 441        Probability, Computing, and Simulation in Statistics
- ST 443        Applied Stochastic Models

<sup>7</sup> MTH 306 (Matrix and Power Series Methods) may be substituted for MTH 253.