UMBC
AN HONORS UNIVERSITY IN MARYLAND

SEARCH

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Courses in this program are listed under MATH and STAT .

The Department of Mathematics and Statistics offers major programs
leading to both the B.A. and B.S. in Mathematics and the B.S. in Statistics.
Students in other departments may pursue a minor or a second major in
mathematics or statistics. Students in mathematics or statistics may obtain
a minor or second major in the other discipline.

The Program in Mathematics

The educational program is designed to give students a broad perspective
on various fields of mathematics. Special emphasis is placed on areas
closely associated with applications, such as mathematical modeling,
differential equations, numerical algorithms and statistical analysis. The
university's state-of-the-art computing facilities are available to all students
and often are used in conjunction with instruction.

Career and Academic Paths

Through their choice of mathematics and statistics electives, students may
tailor their program for a wide variety of career goals. Mathematics and
statistics majors are in great demand in the increasing interdisciplinary
world.

UMBC students have used a degree in mathematics or statistics as a
launching pad for a wide variety of careers ranging from information
technology to pursuing a law degree. Working as a mathematician or
statistician in the industry or government, becoming an actuary, secondary
school teaching, and pursuing a graduate degree in a subject of their
choice are just a few options for a graduate.

Concentration for Graduate Study

This is particularly appropriate for those who wish to pursue advanced
studies in mathematics at the graduate level. French, German or Russian
should be used to satisfy language General Foundation Requirements,
because these languages are a requirement of some graduate institutions.

Concentration in Applied Mathematics

This is recommended for students who wish to prepare for industrial
employment with engineering or physical science applications, immediately
after obtaining a baccalaureate degree, either B.S. or B.A. The emphasis
in this concentration is applications in which physical phenomena and
processes are modeled with differential equations and the numerical solutions of these systems.

Concentration in Optimization and Operations Research

This is recommended for students who wish to prepare for industrial employment as applied mathematicians/ operations researchers. It is also particularly appropriate for those interested in the optimization techniques applicable to economics, management science, engineering and physical sciences.

Concentration in Actuarial Science

This is designed for students who wish to prepare for a career in actuarial mathematics. Courses in this concentration will prepare a student for the first examinations administered by the Society of Actuaries.

Concentration in Mathematics Education

This has been developed in cooperation with the UMBC Department of Education and is specifically designed for students who wish to become certified as secondary school mathematics teachers. Students should consult with an advisor in the Department of Education for specific requirements for certification.

Concentration in Statistical Sciences

This is designed for students who wish to prepare for careers as statisticians or for other careers heavily using probability and statistics. This concentration is appropriate for students who pursue graduate study in statistics.

B.S. in Statistics

The B.S. in Statistics is described following the description of the major in mathematics. Majors in mathematics also may pursue a second major in statistics to obtain greater depth than the concentration in statistical sciences provides. At least five upper-division electives beyond core requirements in mathematics must be mathematics courses if a student is to receive a double major or dual degree in mathematics and statistics.

Academic Advising

After declaration of a major or minor in mathematics, each student will be assigned an advisor from the faculty of the department. Students must consult with their major and minor advisors prior to each registration. This is the case even if a student has another major and minor advisor in that major. Mathematics majors obtaining certification in education should consult advisors in the Department of Education in addition to their advisors in the Department of Mathematics and Statistics.

Degree Requirements

The Bachelor of Science degree requires a minimum of 61 credits. The Bachelor of Arts degree requires a minimum of 50 credits, and a minor in mathematics requires a minimum of 31 credits. These are allocated below between core requirements, upper-division mathematics/statistics elective requirements and supplementary elective requirements.

For all mathematics majors and minors, a common core of courses is required. These core requirements are the same for candidates for the Bachelor of Arts and for mathematics minors. Candidates for the Bachelor of Science degree must complete three additional courses for their core requirements.

Core Requirements for the Bachelor of Arts Degree and for the Minor in Mathematics

- MATH 151
  Calculus and Analytic Geometry I
- MATH 152
  Calculus and Analytic Geometry II
- MATH 221
  Introduction to Linear Algebra
- MATH 225
  Introduction to Differential Equations
- MATH 251
  Multivariable Calculus
- MATH 301
  Introduction to Mathematical Analysis I
- CMSC 201
  Computer Science I

Note:

a) Core requirements MATH 151, MATH 152, CMSC 201 are fulfilled by sufficiently high scores on AP or CLEP or IB examinations. See Appendices of this catalog for details.

b) The sequence MATH 140, 141, 142 is equivalent to MATH 151, 152. Students may not receive credit for both sequences.

c) Students may need to take CMSC 104 prior to CMSC 201.

Core Requirements for the Bachelor of Science Degree

In addition to the core requirements listed above, the Bachelor of Science degree requires the following:

- MATH 302
  Introduction to Mathematical Analysis II *OR*
- MATH 401
  Mathematical Analysis
- PHYS 121
  Introductory Physics I
- PHYS 122
  Introductory Physics II

The above cannot be used to fulfill mathematics elective requirements or supplementary elective requirements.

Mathematics/Statistics Elective Requirements

After completion of the core requirements, each major or minor is required to take a certain number of additional three- or four-credit mathematics or statistics courses numbered 300 or higher. MATH 380, STAT 350 and STAT 351, designed for other majors, are not allowed to meet the requirements below. MATH 432 may not be used as a mathematics elective, but it may be used as a supplementary elective. NOTE: MATH 432 and MATH 481 are GEP writing intensive courses.

Minor in Mathematics

Two courses

B.A. degree

Five courses

B.S. degree

Six courses

For one of the mathematical electives, a major may bundle together three or more credits from courses carrying one or two credits. These include: MATH 426, 427, 479, 480, 490, 496, 499 and STAT 432, 470, 490, 496 and 499.

For the B.S. in Mathematics, at least three of the mathematics/statistics electives must be at the 400 level,

For the B.A., at least two of the mathematics/statistics electives must be at the 400 level.

Listed below are suggested electives for each concentration mentioned previously.

Concentration for Graduate Study

- MATH 302
  Introduction to Mathematical Analysis II *OR*
- MATH 401
  Mathematical Analysis
- MATH 306
  Geometry
- MATH 404
  Introduction to Partial Differential Equations
- MATH 407
  Introduction to Modern Algebra and Number Theory
- MATH 408
  Abstract Algebra
- MATH 410
  Introduction to Complex Analysis
- MATH 411
  Linear Algebra
- MATH 421
  Introduction to Topology
- MATH 430
  Matrix Analysis
- MATH 423
  Differential Geometry
- MATH 441
  Introduction to Numerical Analysis

- STAT 451
  Introduction to Probability Theory
- MATH 475
  Combinatorics and Graph Theory
- MATH 497
  Senior Thesis

Note: Students preparing for graduate study should take as many courses beyond those mathematics/statistics electives required for the B.A. or B.S. as possible. This will increase both their depth and breadth of mathematical knowledge.

Concentration in Applied Mathematics

- MATH 302
  Introduction to Mathematical Analysis II *OR*
- MATH 401
  Mathematical Analysis
- MATH 341
  Computational Methods
- MATH 385
  Introduction to Mathematical Modeling
- MATH 404
  Introduction to Partial Differential Equations
- MATH 410
  Introduction to Complex Analysis
- MATH 423
  Differential Geometry
- MATH 430
  Matrix Analysis
- MATH 441 Introduction to Numerical Analysis
- MATH 447
  Introduction to Parallel Computing
- MATH 456
  Mathematical Methods for Science and Engineering
- MATH 481
  Mathematical Modeling
- MATH 485
  Introduction to the Calculus of Variations

Concentration in Optimization and Operations Research

- MATH 381
  Linear Methods of Operations Research
- MATH 411
  Linear Algebra
- MATH 430
  Matrix Analysis
- MATH 452
  Introduction to Stochastic Processes
- MATH 475
  Combinatorics and Graph Theory
- MATH 481
  Mathematical Modeling
- MATH 482
  Non-linear Optimization
- MATH 483
  Linear and Combinatorial Optimization
- MATH 484
  Stochastic Methods in Operations Research
- MATH 495
  Topics in Mathematics of Operations Research
- STAT 451
  Introduction to Probability Theory

Concentration in Actuarial Science

- STAT 417
  Introduction to Time Series Data Analysis

- STAT 451
  Introduction to Probability Theory
- STAT 453
  Introduction to Mathematical Statistics
- STAT 454
  Applied Statistics
- STAT 470
  Probability for Actuarial Science

Students are advised to take the following courses that have been approved by Society of Actuaries to satisfy its Validation by Educational Experience (VEE) requirement in three topics.

VEE - Applied Statistical Methods:

STAT 417 and STAT 454

VEE - Economics:

ECON 101 and ECON 102

VEE - Corporate Finance:

ECON 374

Concentration in Statistical Sciences

- STAT 451
  Introduction to Probability Theory
- STAT 453
  Introduction to Mathematical Statistics
- STAT 454
  Applied Statistics
- MATH 430
  Matrix Analysis
- MATH 452
  Introduction to Stochastic Processes
- Other 400-level STAT courses

Concentration in Mathematics Education

- MATH 341
  Computational Methods
- MATH 385
  Introduction to Mathematical Modeling
- MATH 407
- Introduction to Modern Algebra and Number Theory
- STAT 355
- Introduction to Probability and Statistics for Scientists and Engineers
- One or two additional Mathematics/Statistics electives at the 400 level

Suggested Supplementary Requirements for Mathematics Education

- MATH 432
  History of Mathematics
- CMSC 203
  Discrete Structures
- EDUC 420
  Teaching Mathematics in the Elementary School *OR*
- EDUC 426
  Teaching Mathematics in the Secondary School

Supplementary Requirements

Mathematics and statistics have proven indispensable in many disciplines in the physical sciences, the social sciences and even in the humanities and arts. Much of mathematics and statistics has developed with a view toward its applications in other fields. To develop an appreciation of the connection, mathematics majors are required to take three courses for the B.A. and two courses for the B.S. additional to the core from other departments reflecting these interconnections. These are listed below. From time to time, special topics courses offered by other departments may be used to satisfy supplementary requirements, subject to departmental approval. Occasionally mathematics or statistics courses are cross-listed in other departments. Taken under the

other department these count as supplementary electives. Mathematics minors are not subject to these supplementary requirements.

Courses for Supplementary Requirements

- BIOL 463
  Theoretical and Quantitative Biology
- CHEM 401
  Chemical and Statistical Thermodynamics
- CHEM 415
  Statistical Mechanics and Theory of Rate Processes
- CMPE 320
  Probability Statistics and Random Processes
- CMPE 323
  Signal and System Theory
- CMSC 203
  Discrete Structures
  *(Must be taken before MATH 301 to be accepted as a supplementary elective)
- CMSC 341
  Data Structures
- CMSC 441
  Algorithms
- CMSC 442
  Information and Coding Theory
- CMSC 443
  Cryptology
- CMSC 451
  Automata Theory and Formal Languages
- CMSC 452
  Logic for Computer Science
- CMSC 453
  Applied Combinatorics and Graph Theory
- ECON 309
  Survey of Economics and Finance for Scientists and Engineers
- ECON 311
  Intermediate Microeconomic Analysis
- ECON 374
  Fundamentals of Financial Management
- ECON 417
  The Economics of Strategic Interaction
- ECON 421
  Introduction to Econometrics
- EDUC 420
  Teaching Mathematics in the Elementary School
- EDUC 426
  Teaching Mathematics in the Secondary School
- ENCH 300
  Chemical Processes and Thermodynamics
- ENME 217
  Engineering Thermodynamics
- ENME 315
  Intermediate Thermodynamics
- ENME 320
  Fluid Mechanics
- ENME 410
  Operations Research
- MATH 432
  History of Mathematics
- PHIL 248
  Introduction to Scientific Reasoning
- PHIL 346
  Deductive Systems
- PHIL 372
  Philosophy of Science
- PHYS 121
  Introductory Physics I
- PHYS 122

Introductory Physics II
- PHYS 224
  Introductory Physics III
- PHYS 303
  Thermal and Statistical Physics
- PHYS 321
  Intermediate Mechanics
- PHYS 407
  Electromagnetic Theory
- PHYS 424
  Introduction to Quantum Mechanics
- PHYS 440
  Computational Physics

Minor in Biomathematics:

The department has a close working relationship with the Department of Biological Sciences in education and research and offers a minor in biomathematics. This minor consists of 30 credits from the following core courses **plus, an additional 6 credit hours from electives** listed below. Two of the <u>core</u> courses cannot be used to satisfy the requirements of any other major and <u>none of the electives</u> can be used to satisfy the requirements of any other major. At least 3 of the elective credits must be from the MATH courses on the list. The Undergraduate Program Director may approve alternative courses in justified individual situations upon petition by the student.

<u>Core Courses</u>

- Biol 141 Foundations of Biology (Cells, Energy, Organisms)
- Biol 142 Foundations of Biology (Ecology/Evolution)
- Biol 302 Molecular and General Genetics
- Stat 350 Statistics with Applications in the Biological Sciences OR
- Stat 355 Introduction to Probability and Statistics for Scientists and Engineers
- Math 151 Calculus and Analytic Geometry I
- Math 152 Calculus and Analytic Geometry II
- Math 221 Introduction to Linear Algebra
- Math 355 Biomathematics

<u>Electives</u>

- Math 385 Introduction to Mathematical Modeling
- Math 426 Introduction to Math Software - MATLAB
- Math 447 Introduction to Parallel Computing
- Math 469 Mathematical Physiology
- Stat 414 Environmental Statistics
- Stat 419 Introduction to Biostatistics
- Stat 432 Statistical Computer Packages
- Stat 454 Applied Statistics

A majority of courses offered toward the minor must be completed in residence at UMBC. A grade of "C" or better must be earned in all courses and prerequisites applied toward the minor. A course taken on a P/F basis will not count toward the minor.

General Education Requirements for Mathematics Majors

Mathematics majors who are considering courses to satisfy General Education Requirements will satisfy the biological/physical science requirements if they take PHYS 121 and 122 and a lab course. For the social science (SS) General Education Requirement, good choices would be ECON 101 and 102, which are prerequisite to supplementary requirement courses ECON 311, 374, 417 and 421. These are recommended in particular for those pursuing the concentration in actuarial science or, to a lesser extent, concentrations in statistics science or optimization and operations research. PHIL 146 and 248 are recommended as choices for AH General Education Requirement courses. The latter is also a supplementary requirement for the major. Note that those pursuing the Bachelor of Science degree need only take one culture course. Both MATH 432 and MATH 481 satisfy the GEP writing intensive requirements. Students may also wish to consider ENGL 393.

General Education Requirements for Non-Majors

Students who are not planning to major in mathematics should elect the mathematics courses that fulfill their general requirements on the basis of their academic program and goals. Students whose major requires or recommends a specific mathematics course should follow that recommendation. Students whose program does not require any mathematics may wish to consider MATH 100, MATH 115 or STAT 121 as one of the courses satisfying the mathematics requirement.

Note: Before registering in any mathematics course up to MATH 151 or MATH 155, students must have completed a placement test administered by the Learning Resources Center if they have not completed the prerequisite college-level course with a "C" or better. This is normally done prior to the first semester at UMBC.

Passage of AP Calculus exams with a suitable score is considered the equivalent of MATH 150, 151 or MATH 152. The AP Statistics exam with a score of 4 or 5 is equal to STAT 121.

Otherwise students must complete MATH 106 with a "C" or better. Even higher algebra skills are recommended for MATH 150 or MATH 155.

The specific courses listed as prerequisites indicate the level of maturity necessary for the course. A student who does not have a formal prerequisite for a particular course must request the consent of the instructor to take that course. Prerequisites for all mathematics courses must be satisfied with a grade of "C" or better.

All courses for major or minor requirements must be passed with a grade of "C" or better.

Honors Program

Students may graduate with departmental honors by completing all major requirements with a GPA of 3.6 or higher and by completing, in addition to other requirements for a major in mathematics, a senior thesis (MATH 497 or STAT 497) with a grade of "A" or "B." Students wishing to graduate with departmental honors must notify the department by the beginning of their senior year.

Evening and Part-time Options

Most freshman and sophomore courses and some upper-divisional courses are offered concurrently in day and evening sections to accommodate working or commuting students. The courses that are not concurrently offered in day and evening sections are rotated between day and evening sections in regular intervals.

It is possible to complete the program of study entirely on a part-time basis. Naturally, the length of study will depend on the number of courses taken each semester. It is possible to accelerate studies by taking some of the courses in the summer. Each summer, the department offers close to 20 undergraduate courses selected from the regular course catalog.

Combined B.S./M.S. Program

For qualified students, the department offers a combined B.S./M.S. program leading to the Bachelor of Science in Mathematics and the Master of Science in Applied Mathematics. By taking advantage of the integrated features of the program, a student can earn two degrees in 141 credits which, if pursued separately, would require at least 150 credits. This allows students to transfer up to nine credits from their undergraduate transcript to their graduate transcript, which results in a corresponding decrease in the number of credits required for completion of the M.S. degree. It is strongly recommended that students in this program take core graduate courses at the 600 level in their senior year.

Interested students should apply for this program after they have completed 60 credits, including transfer credits, toward a Bachelor of Arts or Bachelor of Science degree. All applicants who have completed MATH 151, 152, 221, 251 and CMSC 201 at UMBC with a GPA of 3.0 or higher will be accepted into the program. Application during or immediately subsequent to taking MATH 301 is recommended. All other applicants will have their applications reviewed by the department and may be admitted provisionally.

Special Opportunities

UMBC's proximity to federal agencies in the Baltimore-Washington area provides ample opportunities for internships and cooperative education experiences during the academic year and the summer. A close relationship exists between UMBC faculty and the staff at the National Security Agency (NSA). Many students have served as interns at NSA and have found employment there.

Upon graduation, others have co-oped at the National Oceanic and Atmospheric Administration, the Environmental Protection Agency and BlueCross/ BlueShield.

Student Organizations

Pi Mu Epsilon; National Mathematics Honors Society

Pi Mu Epsilon, the national mathematics honors society, has an active chapter at UMBC and organizes joint activities with the Mathematics and Statistics Council of Majors.

Mu Sigma Rho; National Statistics Honors Society

Mu Sigma Rho is the national honorary society for statistics. Its purpose is the promotion and encouragement of scholarly activity in statistics, and the recognition of outstanding achievement among the students and instructional staff in eligible academic institutions. The alpha chapter of Maryland at UMBC, initiated in 2007, organizes joint activities with the Mathematics and Statistics Council of Majors.

The Program in Statistics

Statistics is the science and art of making inferences from data under conditions of uncertainty. The practice of statistics requires not only an understanding of statistical techniques, but also some understanding of the nuances of the problem requiring statistical analysis - whether it is in the social or physical sciences, engineering, medicine or business.

The major program leading to a B.S. in Statistics, offered by the Department of Mathematics and Statistics, is geared toward the above goal. The educational program is designed to give students a broad perspective on the theory and applications of statistics. In particular, the interdisciplinary curriculum structure of the program helps develop skills in the application of statistical methods to a variety of disciplines. The university's state-of-the-art computing facilities are available to all students and are used in conjunction with instruction.

UMBC is the only institution in Maryland offering an undergraduate major in statistics. Students from other fields may obtain a minor in statistics.

Career and Academic Paths

The use of statistical methods to address complex problems is pervasive in almost all areas of business, government and science, and this has created a growing demand for statisticians. UMBC's location puts it at the heart of some of the most exciting statistical work in the nation, carried out at the Census Bureau (Suitland, MD), Bureau of Labor Statistics (Washington, D.C.), U.S. Environmental Protection Agency (Washington, D.C.), National Center for Health Statistics (Hyattsville, MD), the Army Research Laboratory (Aberdeen Proving Ground, MD), National Institutes of Health (Bethesda, MD), and the Food and Drug Administration (Rockville, MD), along with several other federal agencies, pharmaceutical companies and other industries. The ever-growing demand for statisticians at these places makes our B.S. in Statistics very attractive.

Statisticians working at the U.S. Census Bureau, Bureau of Labor Statistics, National Center for Health Statistics, etc., are required to work on various applications, including design and analysis of surveys, evaluation of non-sampling errors resulting from non-response and research to reduce these errors.

Statisticians working at pharmaceutical companies are required to be knowledgeable in biostatistics. Our B.S. program (applied statistics track) is tailored toward the needs of federal agencies, pharmaceutical companies and industries in general.

In addition, there is a heavy demand for statisticians who have completed graduate degrees (M.S. or Ph.D.). The mathematical statistics track in the B.S. program prepares students to pursue graduate study in statistics.

Academic Advising

Subsequent to the declaration of a major in statistics, each student will be assigned an advisor from the statistics faculty of the department. Students must consult with their advisor prior to course registration. In addition to keeping track of each student's academic progress through the academic program, the faculty advisor is available to discuss related issues such as career goals, internship opportunities, opportunities for graduate study, etc. The departmental advising process is designed to give each student individual attention and guidance.

The B.S. Program in Statistics

Students may tailor their program of study by choosing one of two tracks: the applied statistics track or the mathematical statistics track. Students in the applied statistics track take courses that help develop skills in the application of statistics to real problems. This track is recommended for students who wish to prepare for employment in government or industry. The applied statistics track is also appropriate for those who wish to pursue graduate study in statistics, with an emphasis on applications. The track in mathematical statistics provides the necessary background and stimulation for graduate study in statistics, applied mathematics or other quantitative fields such as computer science or engineering.

The Bachelor of Science in Statistics consists of at least 64 credits, distributed as follows:

The Applied Statistics Track

Core Requirements for the B.S. Degree

All majors in the applied statistics track must successfully complete:

All of the following courses:

- MATH 151
  Calculus and Analytic Geometry I [4]
- MATH 152
  Calculus and Analytic Geometry II [4]
- MATH 221
  Introduction to Linear Algebra [3]

- MATH 251
  Multivariable Calculus [4]

One Course From:

- STAT 350
  Statistics With Applications in the Biological Sciences [4] *OR*
- STAT 351
  Applied Statistics for Business and Economics [4] *OR*
- STAT 355
  Introduction to Probability and Statistics for Scientists and Engineers[4]
- CMPE 320

All of the following courses:

- STAT 433
  Statistical Computing [3]
- STAT 451
  Introduction to Probability Theory [3]
- STAT 453
  Introduction to Mathematical Statistics [3]
- STAT 454
  Applied Statistics [3]

Electives

Majors in the applied statistics track must successfully complete nine elective courses, with at least four courses in statistics. Electives are to be chosen with departmental approval. Some suggested electives are:

Electives in mathematics and statistics:

- MATH 301
  Introduction to Mathematical Analysis I [4]
- MATH 302
  Introduction to Mathematical Analysis II [3]
- MATH 341 - Computational Methods (3)
- MATH 381
  Linear Methods in Operations Research [3]
- MATH 430
  Matrix Analysis [3]
- MATH 441
  Introduction to Numerical Analysis
- MATH 452
  Introduction to Stochastic Processes [3]
- STAT 405
  Survey Sampling [3]
- STAT 414
  Environmental Statistics [3]
- STAT 417
  Introduction to Time Series Data Analysis [3]
- STAT 418
  Applied Multivariate Methods [3]
- STAT 419
  Introduction to Biostatistics [3]
- STAT 455
  Design of Experiments and Quality Control [3]

Electives in other fields:

- CMSC 201
  Computer Science I for Majors [4] *OR*
- CMSC 202
  Computer Science II for Majors [4]
- CMSC 331
  Principles of Programming Languages [3]
- CMSC 341
  Data Structures [3]
- ECON 421
  Introduction to Econometrics [3]

- ECON 422
  Topics in Econometrics [3]
- ECON 423
  Economic Forecasting [3]
- IS 410
  Introduction to Database Program Development [3]
- IS 420
  Advanced Database Project [3]
- IS 427
  Artificial Intelligence [3]
- IS 444
  Total Quality Management for the Information Systems Department [3]
- POLI 400
  Qualitative Research Methods in Political Science [3]
- PSYC 331
  Experimental Psychology - Design and Analysis I [4]
- PSYC 332
  Experimental Psychology - Design and Analysis II [4]
- SOCY 419
  Qualitative Methods in Social Research [3]

Other electives will be permitted with departmental approval.

The Mathematical Statistics Track

Core Requirements for the B.S. Degree

All majors in the mathematical statistics track must successfully complete:

- MATH 151
  Calculus and Analytic Geometry I [4]
- MATH 152
  Calculus and Analytic Geometry II [4]
- MATH 221
  Introduction to Linear Algebra [3]
- MATH 251
  Multivariable Calculus [4]
- MATH 301
  Introduction to Mathematical Analysis I [4]
- STAT 433
  Statistical Computing [3]
- STAT 451
  Introduction to Probability Theory [3]
- STAT 453
  Introduction to Mathematical Statistics [3]
- STAT 454
  Applied Statistics [3]

Electives

Majors in the mathematical statistics track must successfully complete nine elective courses, with at least six courses in mathematics and statistics. The electives may be chosen from the suggested list of electives for the applied statistics track. The electives are to be chosen with departmental approval. Electives other than those among the suggested list will be permitted with departmental approval.

Proficiency in English

All statistics majors in either track must demonstrate their proficiency in English by passing ENGL 393: Technical Writing and by passing a course in speech. (SPCH) Note that ENGL 393 satisfies the GEP writing intensive requirement.

Honors Program

Students may graduate with departmental honors by completing all major requirements with a GPA of 3.6 or higher and by completing, in addition to other requirements for a major in statistics, a senior thesis (STAT 497 or MATH 497) with a grade of "A" or "B." Students wishing to graduate with departmental honors must notify the department by the beginning of their senior year.

Combined B.S./M.S. Program

A combined B.S./M.S. program is available for qualified students. The program leads to the B.S. and M.S. degrees in Statistics. A total of up to nine credit hours will be allowed, with departmental approval, for combined undergraduate and graduate credit. Application may be made after completing the following courses with a "B" average: MATH 151, 152, 221, 251 and STAT 451, 453 and 454. By the time the student has earned nine graduate credits, he or she must have completed the regular application process for formal admittance to the M.S. program.

Minor in Statistics

The minor program in statistics requires:

- MATH 151
  Calculus and Analytic Geometry I [4]
- MATH 152
  Calculus and Analytic Geometry II [4]

AND one of the following options:

1) One 300 level course from:

- STAT 350
  Statistics with Applications in the Biological Sciences [4] *OR*
- STAT 351
  Applied Statistics for Business and Economics *OR*
- STAT 355
  Introduction to Probability and Statistics for Scientists and Engineers [4]

AND three additional 400-level courses in statistics

Credit will not be given to STAT 350, 351 or 355 if taken after completing STAT 451. Those students who first complete STAT 451 should choose option two to satisfy the minor requirements. Students should note that there are limited choices for 400-level courses with Stat 350 or Stat 351 as prerequisites. Discussion with an advisor is recommended.

2) STAT 451 Introduction to Probability Theory [3]

AND Three additional 400-level courses in statistics

Those students who follow Option 1 will complete at least 21 credits of course work in mathematics and statistics toward the minor. Those who follow Option 2 will complete at least 24 credits of course work in mathematics and statistics toward the minor. Note that Math 251 is a prerequisite for Stat 451.

Special Note to Mathematics Majors:

Mathematics majors can satisfy the requirements for a minor in Statistics by making sure to take at least two 400-level courses in Statistics that do not also count toward the Mathematics major.

Special Opportunities

UMBC's proximity to federal agencies, pharmaceutical companies and other industries in the Baltimore-Washington area provides students ample opportunities to gain hands-on experience in applied statistical work through cooperative educational experiences and internships during the academic year and during summer. The department is very proactive in finding internship opportunities for students.