AMS

Applied Mathematics and Statistics

AMS 102: Elements of Statistics
The use and misuse of statistics in real life situations; basic statistical measures of central tendency and of dispersion, frequency distributions, elements of probability, binomial and normal distributions, small and large sample hypothesis testing, confidence intervals, chi square test, and regression. May not be taken by students with credit for AMS 110, 311, 312; ECO 320; POL 201; PSY 201; or SOC 202. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so.

Prerequisite: Satisfaction of entry skill in mathematics requirement (Skill 1) or satisfactory completion of D.E.C. C or QPS; Non AMS majors only
Anti-requisite: May not be taken by students with credit for AMS 110 or AMS 310.

DEC: C
SBC: QPS
3 credits

AMS 103: Applied Mathematics in Modern Technology
Technologies that drive our modern world rely critically on applied mathematics. This course explores "How does it work?" for selected technologies that rely on mathematics and statistics, e.g., internet search, social networking, financial markets, online auctions, cell phones, DNA sequencing, GPS, Wii, Google maps, and more.

Prerequisite: Level 3 or higher on the mathematics placement examination

SBC: QPS, TECH
3 credits

AMS 105: Introduction to Business Statistics
The application of current statistical methods to problems in the modern business environment. Topics include probability, random variables, sampling techniques, confidence intervals, hypothesis testing, and regression. Students analyze real data sets using standard statistical software, interpret the output, and write extensively about the results.

Prerequisite: BUS Maj/Min, CME Major, or ISE Major.
Advisory Prerequisite: BUS 110, 111, 112, 115, or MAT 122. BUS or ISE Major: BUS 210

AMS 110: Probability and Statistics in the Life Sciences
A survey of probability theory and statistical techniques with applications to biological and biomedical situations. Topics covered include Markov chain models; binomial, Poisson, normal, exponential, and chi square random variables; tests of hypotheses; confidence intervals; tests; and analysis of variance, regression, and contingency tables. May not be taken for credit in addition to AMS 310. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so.

Prerequisite: AMS 151 or MAT 125 or 131 or 141.
Anti-requisite: May not be taken by students with credit for AMS 102 or AMS 310.

SBC: QPS
3 credits

AMS 151: Applied Calculus I
A review of functions and their applications; analytic methods of differentiation; interpretations and applications of differentiation; introduction to integration. Intended for CEAS majors. Not for credit in addition to MAT 125 or 126 or 131 or 141. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so.

Prerequisite: B or higher in MAT 123 or level 5 on the mathematics placement examination

DEC: C
SBC: QPS
3 credits

AMS 156: Applied Linear Algebra

Prerequisite: AMS 151 or MAT 131 or 141 or corequisite MAT 126 or level 7 or higher on the mathematics placement exam

SBC: STEM+
3 credits

AMS 201: Applied Linear Algebra

Prerequisite: AMS 151 or MAT 131 or 141 or corequisite MAT 126 or level 7 or higher on the mathematics placement exam

SBC: STEM+
3 credits

AMS 261: Applied Calculus III
Vector algebra and analytic geometry in two and three dimensions; multivariable differential calculus and tangent planes; multivariable integral calculus; optimization and Lagrange multipliers; vector calculus including Green's and Stokes's theorems. May not be taken for credit in addition to MAT 203 or 205.

Prerequisite: AMS 161 or MAT 127 or 132 or 142 or MPE level 9

SBC: STEM+
4 credits

AMS 300: Writing in Applied Mathematics
See Requirements for the Major in Applied Mathematics and Statistics, Upper Division Writing Requirement.

Prerequisites: WRT 102; AMS major; U3 or U4 standing

SBC: SPK, WRTD
1 credit, S/U grading

AMS 301: Finite Mathematical Structures
An introduction to graph theory and combinatorial analysis. The emphasis is on solving applied problems rather than on theorems and proofs. Techniques used in problem solving include generating functions, recurrence relations, and network flows. This course develops the type of mathematical thinking that is fundamental to computer science and operations research.

Prerequisite: AMS 210 or MAT 211 or AMS 361 or MAT 303

SBC: STEM+
3 credits

AMS 303: Graph Theory
Paths and circuits, trees and tree based algorithms, graph coloring, digraphs, network flows, matching theory, matroids, and games with graphs.
AMS 310: Survey of Probability and Statistics
A survey of data analysis, probability theory, and statistics. Stem and leaf displays, box plots, schematic plots, fitting straight line relationships, discrete and continuous probability distributions, conditional distributions, binomial distribution, normal and t distributions, confidence intervals, and significance tests. May not be taken for credit in addition to ECO 320. This course has been designated as a High Demand/Controlled Access (HD/CA) course. Students registering for HD/CA courses for the first time will have priority to do so.
Prerequisite: AMS 161 or MAT 132 or MAT 126 or MAT 142
SBC: STEM+
3 credits

AMS 311: Probability Theory
Probability spaces, random variables, moment generating functions, algebra of expectations, conditional and marginal distributions, multivariate distributions, order statistics, law of large numbers.
Prerequisites: AMS 301 and 310 or permission of instructor
Corequisites: MAT 203 or 205 or AMS 261
3 credits

AMS 315: Data Analysis
A continuation of AMS 310 that covers two sample t-tests, contingency table methods, the one-way analysis of variance, and regression analysis with one and multiple independent variables. Student projects analyze data provided by the instructor and require the use of a statistical computing package such as SAS or SPSS. An introduction to ethical and professional standards of conduct for statisticians will be provided.
Prerequisite: AMS 310
SBC: CER, ESI
3 credits

AMS 316: Introduction to Time Series Analysis
Trend and seasonal components of time series models, autoregressive and moving average (ARMA) models, Box-Jenkins methodology, Portmanteau test, unit-root, generalized autoregressive conditionally heteroskedasticity (GARCH) models, exponential GARCH, stochastic volatility models. This course is offered as both AMS 316 and AMS 586.
Prerequisite: AMS 311 and AMS 315

SBC: SBS+
3 credits

AMS 318: Financial Mathematics
This course will focus on accumulation functions, yield rates, annuities, loan repayment, term structure of interest rates/spot rates/forward rates, options, duration/convexity. This course follows the syllabus for the Financial Mathematics (FM) Exam of the Society of Actuaries and prepares students to pass the FM Exam.
Prerequisite: AMS 310
SBC: WRTD
3 credits

AMS 320: Introduction to Quantitative Finance
The course introduces the main classes of financial securities, the mathematical tools employed to model their prices, and common models for risk and investment management. Building realistic models relies on having a working knowledge of the empirical properties of financial asset returns which is another focus of the course. R is used as an environment for modeling.
Prerequisite: AMS 311
SBC: WRTD
3 credits

AMS 321: Computer Projects in Applied Mathematics
The simulation methodology for a variety of applied mathematical problems in numerical linear and nonlinear algebra, statistical modeling, and numerical differentiation and integration. Graphical representation of numerical solutions.
Prerequisites: AMS 210 or 261 or MAT 203: prior programming experience in C, FORTRAN, or Java
SBC: WRTD
3 credits

AMS 326: Numerical Analysis
Prerequisites: CSE 101; AMS 161; basic skills in using a high-level programming language (C, C++, or Java).
Advisory prerequisite: AMS 210
SBC: WRTD
3 credits

AMS 332: Computational Modeling of Physiological Systems
Introduces students to the fundamental principles underlying computational modeling of complex physiological systems. A major focus of the course will be on the process by which a model of a biological system is developed. Students will be introduced to the mathematical methods required for the modeling of complex systems (including stochastic processes and both temporal and spatial dynamics) as well as to tools for computational simulation. Roughly one half of the class will focus on models for general cellular physiology, while the remaining half will focus on the development of higher-level models of a particular physiological system (for example, the neurobiological systems underlying learning). This course is offered as both AMS 332 and BIO 332.
Prerequisite: MAT 127 or MAT 132 or higher and any one of the following: BIO 202 or BIO 203 or CHE 132 or CHE 331 or PHY 127 or PHY 132
3 credits

AMS 333: Mathematical Biology
This course introduces the use of mathematics and computer simulation to study a wide range of problems in biology. Topics include the modeling of populations, the dynamics of signal transduction and gene-regulatory networks, and simulation of protein structure and dynamics. A computer laboratory component allows students to apply their knowledge to real-world problems.
Prerequisites: AMS 161 or MAT 132; BIO 202; U3 or U4 standing; or permission of the instructor
SBC: EXP+, WRTD
3 credits

AMS 335: Game Theory
Introduction to game theory fundamentals with special emphasis on problems from economics and political science. Topics include strategic games and Nash equilibrium, games in coalitional form and the core, bargaining theory, measuring power in voting systems, problems of fair division, and optimal and stable matching. This course is offered as both AMS 335 and ECO 355.
Prerequisites: MAT 126 or 131 or 141 or AMS 151; C or higher in ECO 303
SBC: WRTD
3 credits

AMS 341: Operations Research I: Deterministic Models
Linear programming with a view toward its uses in economics and systems analysis. Linear algebra and geometric foundations of linear programming; simplex method and its variations; primal dual programs;
formulation and interpretation of linear programming models, including practical problems in transportation and production control. Optional computer projects. AMS 341 and 342 may be taken in either order, though it is recommended that AMS 341 be taken first.

**Prerequisites:** AMS 210 or MAT 211

**SBC:** SBS+

3 credits

**AMS 342: Operations Research II: Stochastic Models**

Methods and techniques for stochastic modeling and optimization, with applications to queuing theory, Markov chains, inventory theory, games, and decisions. AMS 341 and 342 may be taken in either order, though it is recommended that AMS 341 be taken first.

**Prerequisites:** AMS 210 or MAT 211; AMS 311

**SBC:** SBS+

3 credits

**AMS 345: Computational Geometry**

The design and analysis of efficient algorithms to solve geometric problems that arise in computer graphics, robotics, geographical information systems, manufacturing, and optimization. Topics include convex hulls, triangulation, Voronoi diagrams, visibility, intersection, robot motion planning, and arrangements. This course is offered as both AMS 345 and CSE 355.

**Prerequisites:** AMS 301; programming knowledge of C or C++ or Java

3 credits

**AMS 351: Applied Algebra**

Topics in algebra: groups, informal set theory, relations, homomorphisms. Applications: error correcting codes, Burnside’s theorem, computational complexity, Chinese remainder theorem. This course is offered as both AMS 351 and MAT 312.

**Prerequisite:** AMS 210 or MAT 211

**Advisory Prerequisite:** MAT 200 or CSE 113

3 credits

**AMS 361: Applied Calculus IV: Differential Equations**

Homogeneous and inhomogeneous linear differential equations; systems of linear differential equations; solution with power series and Laplace transforms; partial differential equations and Fourier series. May not be taken for credit in addition to the equivalent MAT 303.

**Prerequisite:** AMS 161 or MAT 127 or 132 or 142 or MPE level 9

**SBC:** STEM+

4 credits

**AMS 394: Statistical Laboratory**

Designed for students interested in statistics and their applications. Basic statistical techniques including sampling, design, regression, and analysis of variance are introduced. Includes the use of statistical packages such as SAS and R. Students translate realistic research problems into a statistical context and perform the analysis.

**Prerequisite:** AMS 310 or AMS 315

**SBC:** CER, ESI, EXP+

3 credits

**AMS 410: Actuarial Mathematics**

Integrates calculus and probability with risk assessment and insurance in a quantitative manner to prepare students for the first actuarial examination.

**Prerequisites:** AMS 261 or MAT 203 or 205; AMS 310; AMS 311 or 315

**SBC:** CER, ESI, EXP+

3 credits

**AMS 412: Mathematical Statistics**

Estimation, confidence intervals, Neyman Pearson lemma, likelihood ratio test, hypothesis testing, chi square test, regression, analysis of variance, nonparametric methods.

**Prerequisite:** AMS 311

**SBC:** CER, ESI, EXP+

3 credits

**AMS 441: Business Enterprise**

Explores the strategy and technology of business enterprises. Integrates the practice of engineering and quantitative methods with the operations of a business in today’s globalized environment, whether in product development, financial management, or e-commerce.

**Prerequisite:** Junior or Senior Standing

3 credits

**AMS 458: Speak Effectively Before an Audience**

A zero credit course that may be taken in conjunction with AMS 475 course that provides opportunity to achieve the learning outcomes of the Stony Brook Curriculum's SPK learning objective.

**Pre- or corequisite:** WRT 102 or equivalent; permission of the instructor

**SBC:** SPK

0 credit, S/U grading

**AMS 459: Write Effectively in Applied Mathematics**

A zero credit course that may be taken in conjunction with AMS 487, with permission of the instructor. The course provides opportunity to practice the skills and techniques of effective academic writing and satisfies the learning outcomes of the Stony Brook Curriculum's WRTD learning objective.

**Prerequisite:** WRT 102; permission of the instructor

**SBC:** WRTD

0 credit, S/U grading

**AMS 475: Undergraduate Teaching Practicum**

Students assist the faculty in teaching by conducting recitation or laboratory sections that supplement a lecture course. The student receives regularly scheduled supervision from the faculty advisor. May be used as an open elective only and repeated once.

**Prerequisites:** U4 standing as an undergraduate major within the college; a minimum g.p.a. of 3.00 in all Stony Brook courses and the grade of B or better in the course in which the student is to assist; permission of department

**SBC:** EXP+, SPK

3 credits

**AMS 476: Undergraduate Teaching Practicum**

Students assist the faculty in teaching by conducting recitation or laboratory sections that supplement a lecture course. The student receives regularly scheduled supervision from the faculty advisor. May be used as an open elective only and repeated once.

**Prerequisites:** U4 standing as an undergraduate major within the college; a minimum g.p.a. of 3.00 in all Stony Brook courses and the grade of B or better in the course in which the student is to assist; permission of department

**SBC:** EXP+, SPK

3 credits

**AMS 487: Research in Applied Mathematics**

An independent research project with faculty supervision. Permission to register requires a B average and the agreement of a faculty member to supervise the research. May be repeated once. Only 3 credits of research electives (AMS 487, CSE 487, MEC 499, ESE 499, ESM 499, EST 499, ISE 487) may be counted toward engineering technical elective requirements.

**Prerequisites:** Permission of instructor and department

**SBC:** EXP+, WRTD
AMS 492: Topics in Applied Mathematics

Treatment of an area of applied mathematics that expands upon the undergraduate curriculum. Topics may include applied mathematics, statistics, or operations research and change from semester to semester. Semester supplements to this Bulletin contain specific description when course is offered. May be repeated once, as the topic changes.

Prerequisite: Permission of instructor

3 credits