

# DEPARTMENT OF MATHEMATICS AND STATISTICS

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## Chair

Dr. Shane Redmond  
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## Faculty

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The Department of Mathematics and Statistics offers degrees and minors in these disciplines, as well as providing college readiness and general education mathematics and statistics courses.

## Bachelor's

- Data Science and Statistics, Bachelor of Science (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/data-science-statistics-bs/>)
- Mathematics, Bachelor of Science with a Concentration in General Mathematics (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/mathematics-concentration-general-bs/>)
- Mathematics, Bachelor of Science with a Concentration in Mathematics Teaching (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/mathematics-concentration-teaching-bs/>)

## Accelerated

- Data Science and Statistics, Bachelor of Science (B.S.) & Applied Mathematics, Master of Arts (M.A.) Accelerated 3+2 Dual Degree Program (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/data-science-statistics-bs-applied-mathematics-ma/>)

## Associate's

*No results were found.*

## Minor

- Actuarial Science, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/actuarial-science-minor/>)
- Mathematical Sciences, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/mathematical-sciences-minor/>)
- Mathematics, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/mathematics-minor/>)

- Mathematics/Teaching, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/mathematics-teaching-minor/>)
- Statistics, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/statistics-minor/>)

## Certificate

- Applied Data Science, University Certificate (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/mathematics-statistics/applied-data-science-certificate/>)

## Courses

### Mathematics

#### **MAT 105. Mathematics with Applications. (3 Credits)**

I, II. Prerequisite: Satisfaction of English and reading academic readiness indicators and either satisfaction of mathematics academic readiness indicators\* or concurrent enrollment in MAT 105P. This course is designed to strengthen computational skills, mathematical reasoning, problems-solving skills, and mathematical reading/ communication skills while focusing on real-world problems. The mathematical topics may include the mathematics of finance, statistics, geometry, combinatorics, mathematical modeling, and algorithms. Use of calculators. Gen. Ed. E-2 [QR].

#### **MAT 105P. Quantitative Support for MAT 105. (1 Credit)**

(1) I, II. Corequisite: MAT 105. Corequisite support for students in MAT 105. Emphasis placed on prerequisite skills such as real number sense and operations, problem solving, analyzing graphs, mathematical modeling, and critical thinking. 2 Lab.

#### **MAT 106. Applied Mathematics: \_\_\_\_. (3 Credits)**

I, II. Prerequisite: Satisfaction of English and reading academic readiness indicators\* and either satisfaction of mathematics academic readiness indicators or concurrent enrollment in MAT 106P. The introduction to the application of mathematics to real-world problems. Topics are from various branches of mathematics such as graph theory, game theory, probability, geometry, and problems from the social sciences. 3 Lec. Gen. Ed. E-2 [QR].

#### **MAT 106P. Quantitative Support for MAT 106. (1 Credit)**

I, II. Corequisite: MAT 106. Corequisite support for students in MAT 106. Emphasis placed on prerequisite skills such as real number sense and operations, problem solving, analyzing graphs, mathematical modeling, and critical thinking. 2 Lab.

#### **MAT 110. Intro to Algebraic Functions. (3 Credits)**

I, II. Prerequisite: Completion of all University developmental requirements. Algebraic modeling with linear, quadratic, polynomial, rational, exponential and logarithmic functions, equations, and inequalities. 3 Lec/1 Lab. Gen Ed. E-2 [QR].

#### **MAT 111A. Quantitative Support: MAT 112A. (0.5 Credits)**

I, II. Formerly MAT 112AP. Corequisite: MAT 112A. Corequisite support for students in MAT 112A. Emphasis placed on prerequisite skills such as real number sense and operations, problem solving, analyzing graphs, factoring, exponents, mathematical modeling, and critical reading and thinking. Credit will not be awarded to students who have credit for MAT 112AP. 2 Lab.

**MAT 111B. Quantitative Support: MAT 112B. (0.5 Credits)**

I, II. Formerly MAT 112BP. Corequisite: MAT 112B. Corequisite support for students in MAT 112B. Emphasis on prerequisite skills including real number sense and operations, problem solving, graphs, factoring, exponents, logarithms, matrices, sequences, mathematical modeling, and critical reading and thinking. Credit will not be awarded to students who have credit for MAT 112BP. 2 Lab.

**MAT 112. Algebra with Applications. (3 Credits)**

(3) I, II. Prerequisite: MAT 098 or MAT 110 with a minimum grade of "C", a minimum score of 22 on the mathematics portion of the ACT, a minimum score of 510 on the mathematics portion of the SAT, or a passing score on an algebra placement test. Students will solve application problems involving linear and quadratic equations, matrices, systems of linear equations, series and sequences, logarithmic and exponential equations; and analyze graphs of linear, quadratic, exponential, logarithmic and power functions. 3 Lec/1 Lab. Gen. Ed. E-2.

**MAT 112A. Algebra: Polynomials. (1.5 Credits)**

I, II. Prerequisite/ Corequisite: Satisfaction of English and reading academic readiness indicators and either satisfaction of algebra readiness indicators\* or concurrent enrollment in MAT 111A. Students will solve application problems involving linear, quadratic, and power equations and analyze graphs of linear, quadratic, and power functions. Credit will not be awarded to students who have credit for MAT 112. 3 Lec /1 Lab. Gen. Ed. E-2 [QR]. General Education credit will not be awarded until after successful completion of both MAT 112A and MAT 112B.

**MAT 112AP. Quantitative Support for MAT 112A. (0.5 Credits)**

(.5) I, II. Corequisite: MAT 112A. Corequisite support for students in MAT 112A. Emphasis placed on prerequisite skills such as real number sense and operations, problem solving, analyzing graphs, factoring, exponents, mathematical modeling, and critical reading and thinking. 2 Lab.

**MAT 112B. Algebra: Functions & Matrices. (1.5 Credits)**

I, II. Prerequisite/Corequisite: MAT 112A (C) and either satisfaction of algebra readiness indicators\* or concurrent enrollment in MAT 111B. Students will solve application problems involving matrices, systems of linear equations, series and sequences, logarithmic and exponential equations; and analyze graphs of exponential and logarithmic functions. Credit will not be awarded to students who have credit for MAT 112. 3 Lec /1 Lab. Gen. Ed. E-2 [QR]. General Education credit will not be awarded until after successful completion of both MAT 112A and MAT 112B.

**MAT 112BP. Quantitative Support for MAT 112B. (0.5 Credits)**

(.5) I, II. Corequisite: MAT 112B. Corequisite support for students in MAT 112B. Emphasis on prerequisite skills including real number sense and operations, problem solving, graphs, factoring, exponents, logarithms, matrices, sequences, mathematical modeling, and critical reading and thinking. 2 Lab.

**MAT 114. College Algebra. (3 Credits)**

(3) I, II. Formerly MAT 107. Prerequisite: MAT 098 or MAT 110 with a minimum grade of "C", a minimum score of 22 on the mathematics portion of the ACT, a minimum score of 530 on the mathematics portion of the SAT, or a passing score on an algebra placement test. Real and complex numbers, integer and rational exponents, polynomial and rational equations and inequalities, graphs of functions and relations, exponential and logarithmic functions. Use of graphing calculators. Credit will not be awarded to students who have credit for MAT 107. 3 Lec/1 Lab. Gen Ed. E-2.

**MAT 115. Introduction to Mathematica. (1 Credit)**

I, II. Prerequisite: MAT 112 or 114 with a minimum grade of "C", or a minimum score of 23 on the mathematics portion of the ACT or a minimum score of 550 on the mathematics portion of the SAT. Use of Mathematica. Numeric, algebraic, and symbolic capabilities, two and three dimensional graphics with animation, decisions, looping, and list manipulation.

**MAT 116. Problem Solving with Math. (2 Credits)**

A. Prerequisite: MAT 115. Basic concepts include functional programming, procedural programming, rule-based programming, recursion, numerics, and graphics programming.

**MAT 120. Trigonometry. (3 Credits)**

I, II. Prerequisite: Prerequisite: MAT 112 or 112B or 114 with a grade of "C" or better, or a Math ACT score of 22 or higher, or a Math SAT score of 560 or higher. Radians and degrees, graphs of trigonometric functions, inverse functions, right and oblique triangles, vectors, and real-world applications. Gen. Ed. E-2 [QR].

**MAT 122. Precalculus Mathematics. (5 Credits)**

(5) I, II. Formerly MAT 109. Prerequisite: MAT 112 or 114 with a grade of "C" or better, a minimum score of 23 on the mathematics portion of the ACT, or a minimum score of 550 on the mathematics portion of the SAT. Polynomial, rational, exponential, logarithmic, and trigonometric functions and inverses. Sequences and series, systems of linear and nonlinear equations and inequalities, the complex number system, vectors, the binomial theorem, mathematical induction, and conic sections. Use of graphing calculators. Credit will not be awarded to those students who have credit for MAT 109. Gen. Ed. E2.

**MAT 201. Mathematical Concepts for Middle and Elementary School Teachers I. (3 Credits)**

I, II. Prerequisites: MAT 112 or higher with a grade of "C" or better, and a passing score on a Mastery Exam. (The prerequisite course requirement can be met by a combination of MAT 106 and a 23 or higher on the mathematics portion of the ACT.) Concepts beyond algorithmic computation are emphasized. Sets and functions, whole numbers, integers, rational numbers, decimals and real numbers, numeration, and elementary number theory.

**MAT 202. Mathematical Concepts for Middle and Elementary School Teachers II. (3 Credits)**

I, II. Prerequisites: MAT 201 and another MAT course numbered 112 or higher with a C or better in each and a passing score on a mastery test. (The MAT requirement of a MAT course numbered 112 or higher can be met by a combination of MAT 106 and a 23 or higher on the mathematics portion of the ACT.) Concepts stressed over manipulation. Geometry, measurement, metric system, probability and basic statistics.

**MAT 203. Geometry for 7-12 Teachers. (3 Credits)**

II. Prerequisites: admission to a teacher certification program; and either MAT 244 with a grade of C or better or a combination of four courses: MAE 201; MAE 202; MAE 302 or EME 301; and one of MAT 112, MAT 114, MAT 211, or MAT 234 or 234 H, with a grade of C or better in each course and a combined grade point of 2.75 in the four courses. Angles and their measurement, right triangle trigonometry, perpendicular lines, congruent triangles, circles, arcs, and angles, constructions and loci, area and volume, similarity, graphing, selected topics from analytic geometry.

**MAT 211. Applied Calculus. (3 Credits)**

A. Prerequisite: MAT 112 or 112B or 114 or 120 or 122 with a grade of "C" or better, or a minimum score of 23 on the mathematics portion of the ACT or a minimum score of 550 on the mathematics portion of the SAT. Functions and graphs, differentiation, integration, exponential and logarithmic functions, and applications for business, economics, and science. Credit will not be awarded to students who have credit for MAT 261. Gen. Ed. Element 2.

**MAT 211L. Applied Calculus Lab. (1-2 Credits)**

I, II. Formerly MAT 217. Prerequisite or Corequisite: MAT 211. This optional lab is to accompany a regular lecture class in Applied Calculus. 2-4 Lab. Credit will not be awarded to students who have credit for MAT 217.

**MAT 234. Calculus I. (4 Credits)**

Formerly MAT 124. Prerequisite: MAT 122 with a grade of "C" or better, a minimum score of 27 on the mathematics portion of the ACT, or a minimum score of 640 on the mathematics portion of the SAT or a passing score on a calculus placement test. Functions, limits, and continuity, derivatives and applications, integration, and introduction to and use of the computer package Mathematica or other appropriate technology. Credit will not be awarded to students who have credit for MAT 124. Gen. Ed. E-2.

**MAT 234L. Calculus I Lab. (1-2 Credits)**

I, II. Formerly MAT 217. Prerequisite or Corequisite: MAT 234. This optional lab is to accompany a regular lecture class in Calculus I. 2-4 Lab. Credit will not be awarded to students who have credit for MAT 217.

**MAT 239. Linear Algebra and Matrices. (3 Credits)**

(3) I, II. Formerly MAT 214. Prerequisite: MAT 234 or 234H with a grade of "C" or better. Real and complex vector spaces, linear transformations, matrix theory, with applications, through the introduction of eigenvalues and eigenvectors, determinants, inner product spaces, the use of technology. Credit will not be awarded to students who have credit for MAT 214.

**MAT 244. Calculus II. (4 Credits)**

I, II. Formerly MAT 224. Prerequisite: MAT 234, or 234H with minimum grade of "C" or better. Fundamental integration techniques, numerical integration, applications of integration, improper integrals, differential equations, infinite series, polar and parametric equations, and use of Mathematica or other appropriate technology. Credit will not be awarded to students who have credit for MAT 224, 224H, or 244N.

**MAT 244L. Calculus II Lab. (1-2 Credits)**

I, II. Formerly MAT 218. Prerequisite or Corequisite: MAT 244. This optional lab is to accompany a regular lecture class in Calculus II. 2-4 Lab. Credit will not be awarded to students who have credit for MAT 218.

**MAT 254. Calculus III. (4 Credits)**

I, II. Formerly: MAT 225. Prerequisite: MAT 244 with a minimum grade of "C" or better. Functions of several variables, limits and continuity, partial derivatives, multiple integrals, vector calculus including Green's, Divergence, and Stoke's theorems, cylindrical and spherical coordinates and use of Mathematica. Credit will not be awarded to students who have credit for MAT 225, 225H.

**MAT 254L. Calculus III Lab. (1-2 Credits)**

I, II. Formerly MAT 219. Prerequisite or Corequisite: MAT 254. This optional lab is to accompany a regular lecture class in Calculus III. 2-4 Lab. Credit will not be awarded to students who have credit for MAT 219.

**MAT 301. Logic and Set Theory. (3 Credits)**

A. Prerequisites: MAT 214, 224 or 224H with minimum grades of  $\geq C$  and a grade point average of at least 2.5 in MAT 124, 214, and 224, or departmental approval. Logic, proof techniques, set theory, relations, functions, cardinality, introduction to advanced mathematics.

**MAT 303. Mathematical Models and Applications. (3 Credits)**

II. Prerequisite: A grade of C or higher in MAT 112, 114, 211, 234, or 234H. Prerequisites or Corequisites: MAT 203 with a grade of C or better. The course emphasizes conceptual understanding and communication of mathematical topics through modeling, problem solving, and technology. Topics include algebra, geometry, probability, statistics, and real-world situations. Credit does not count toward the B.S. in mathematics nor the B.S. in mathematics teaching nor the mathematics minor.

**MAT 306. Discrete Mathematics. (3 Credits)**

II. Prerequisites: MAT 239 and 244 each with a minimum grade of "C" and at least 2.5 GPA in all mathematics courses. Counting principles, permutations, combinations, recurrence relations, graphs, representations of graphs as matrices, trees, networks, difference equations, and linear programming.

**MAT 308. Modern Algebra I. (3 Credits)**

I. Prerequisite: MAT 301 with a minimum grade of "C" (2.0). Groups, cyclic and permutation groups, homomorphisms, subgroups and factor groups, Fundamental Theorem of Finite Abelian Groups, rings, fields, integral domains, and ideals.

**MAT 315. Introduction to Analysis. (3 Credits)**

II. Prerequisite: MAT 301, 225 or MAT 225H with a minimum grade of "C". Real number system, sets and functions, limits, continuity, uniform continuity, Taylor's theorem, laws of the mean, the Riemann integral, allied topics.

**MAT 334. Modern College Geometry I. (3 Credits)**

A. Prerequisite or Corequisite: MAT 301 with a minimum grade of  $\geq C$ .  $\geq$  Euclid's parallel postulate, axiom systems, finite geometries.

**MAT 349. Applied Learning in Mathematics. (0.5-8 Credits)**

I, II; (1-6) SUMMER ONLY. Prerequisite: departmental approval. Work in placements related to academic studies. Credit does not apply to major or minor requirements. Total hours: eight, associate; sixteen, baccalaureate. A minimum of 80 hours of employment are required for each semester hour of academic credit.

**MAT 349A. Cooperative Study: Mathematics. (0.5-8 Credits)**

(1-8) I, II; (1-6) SUMMER ONLY. Prerequisite: departmental approval. Work in placements related to academic studies. Credit does not apply to major or minor requirements. Total hours: eight, associate; sixteen, baccalaureate. A minimum of 80 hours of employment are required for each semester hour of academic credit.

**MAT 349B. Cooperative Study: Mathematics. (0.5-8 Credits)**

Work in placements related to academic studies. Credit does not apply to major or minor requirements.

**MAT 349C. Cooperative Study: Mathematics. (0.5-8 Credits)**

Work in placements related to academic studies. Credit does not apply to major or minor requirements.

**MAT 349D. Cooperative Study: Mathematics. (0.5-8 Credits)**

Work in placements related to academic studies. Credit does not apply to major or minor requirements.

**MAT 349E. Cooperative Study: Mathematics. (0.5-8 Credits)**

Work in placements related to academic studies. Credit does not apply to major or minor requirements.

**MAT 349F. Cooperative Study: Mathematics. (0.5-8 Credits)**

Work in placements related to academic studies. Credit does not apply to major or minor requirements.

**MAT 353. Differential Equations. (3 Credits)**

A. Prerequisite: MAT 224 or 224H with a minimum grade of  $\zeta$ C.  $\zeta$  Differential equations of first order, applications, singular solutions, linear equations with constant coefficients, miscellaneous methods for equations of higher order, solution in series, total differential equations, qualitative methods, systems of linear differential equations, the computer algebra systems.

**MAT 380. Mathematics in a Historical. (3 Credits)**

A. Prerequisite or Corequisite: MAT 301 or departmental approval. The history of mathematics from ancient beginnings until modern times is studied through problems and through the lives and times of mathematicians.

**MAT 408. Modern Algebra II. (3 Credits)**

A. Prerequisite: MAT 308 with a minimum grade of  $\zeta$ C.  $\zeta$  Ring homomorphisms, polynomial rings, unique factorization domains, principal ideal domains, finite fields, field extensions, algebraic extensions, Galois theory, and geometric construction.

**MAT 415. Analysis. (3 Credits)**

A. Prerequisite: MAT 315 with a minimum grade of  $\zeta$ C.  $\zeta$  The Riemann integral, the Lebesgue integral, metric spaces, differentiation, sequences and series of functions, allied topics.

**MAT 480. Seminar in:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: departmental approval. Advanced topics in undergraduate mathematics. May be retaken to a maximum of nine hours, provided the topics are different.

**MAT 495. Independent Work. (1-3 Credits)**

A. Prerequisite: departmental approval. Directed study/ research on a problem or area chosen in consultation with instructor. Final paper required. Student must have the independent study proposal form approved by faculty supervisor and department chair prior to enrollment. May be retaken to maximum of six hours.

**MAT 498. Mathematics Capstone. (1 Credit)**

A. Prerequisite: senior status as a Mathematics major. Designed to enable students to synthesize and integrate their mathematical and statistical knowledge. Students will learn how to conduct research and present the results.

**MAT 501. Applicat of Math for P-9 Teach. (3 Credits)**

A. Prerequisite: MAT 303. Topics in the application of mathematical models appropriate for teachers of grades P-9. Credit does not apply toward B.S. or degree requirements for programs offered within this department.

**MAT 502. Geom with Tech for P-9 Teah. (3 Credits)**

A. Prerequisites: MAT 203 and MAE 305. Topics in geometry appropriate for teachers of grades P-9. Credit does not apply toward either B.S. degree requirements for programs offered within this department.

**MAT 505. Foundations of Mathematics. (3 Credits)**

A. Prerequisite: MAT 308 with a minimum grade of  $\zeta$ C.  $\zeta$  The nature of mathematical thought; logical systems; axiomatic concepts and methods; consideration of the work of Hilbert, Peano, Whitehead, Russell, and others.

**MAT 506. Number Theory. (3 Credits)**

Fundamental properties of integers, linear Diophantine equations, linear and quadratic congruences, famous problems of number theory.

**MAT 507. Seminar in Mathematics:\_\_\_\_. (1-3 Credits)**

Topics vary with offering. May be retaken with advisor approval, provided the topics are different. Credit towards degree requirements will depend on course content.

**MAT 520. Mathematical Statistics I. (3 Credits)**

I. Cross listed as STA 520. Prerequisite: STA 215 or 270. Prerequisite or Corequisite: MAT 254 or 254H. Descriptive statistics, discrete and continuous probability distributions for one and two variables, functions of random variables, sampling distributions, expectations and generating functions. Credit will not be awarded to students who have credit for STA 520.

**MAT 525. Vector Analysis with Applications. (3 Credits)**

A. Prerequisite: MAT 225 or 225H with a minimum grade of  $\zeta$ C.  $\zeta$  Algebra and geometry of vectors; vector functions of a single variable; line, surface, and volume integrals; Divergence Theorem, Stokes  $\zeta$  Theorem, Green  $\zeta$ s Theorem; generalized orthogonal coordinates; Fourier Series; solutions to boundary value problems.

**MAT 527. Cryptology. (3 Credits)**

(3) A. Prerequisites: Senior standing and MAT 301. Classical cryptosystems, basic number theory, DES, Advanced Encryption Standard, RSA, discrete logs, digital signatures, elliptic curve cryptosystem, lattice methods. It is strongly recommended that students have completed a course in proof writing.

**MAT 535. Principles of Geometry. (3 Credits)**

A. Prerequisite: MAT 334 with a minimum grade of "C." Two- and three-dimensional analytical Euclidean geometry, alternate geometries such as hyperbolic, Riemannian, taxicab and affine.

**MAT 540. Applications of Partial Differential Equations. (3 Credits)**

A. Prerequisite: MAT 353 with a minimum grade of "C". Wave, heat/diffusion and potential/Laplace equations, separation of variables, orthogonal sets of functions. Fourier series, boundary value problems, Fourier integrals, maximum principles, the Cauchy problem.

**MAT 550. Applications of Complex Analysis. (3 Credits)**

A. Prerequisite: MAT 225 or 225H or 353 with a minimum grade of  $\zeta$ C.  $\zeta$  Continuity, differentiation, integration, series, residues, and applications to the evaluation of real integrals. Applications of conformal mappings to boundary value problems in heat, electrostatic potential, and fluid flow. Emphasis throughout on computational techniques and applications.

**MAT 555. Graph Theory. (3 Credits)**

A. Prerequisite: MAT 308 or CSC 320 with a minimum grade of  $\zeta$ C.  $\zeta$  Introduction to the theory and applications of graph theory. Topics will include trees, planarity, connectivity, flows, matching, and coloring.

**MAT 560. Point Set Topology. (3 Credits)**

An introduction to topology with emphasis on Euclidean and other metric spaces. Mappings, connectivity, compactness, formation of new spaces, relationship to analysis.

**MAT 565. Mathematics of Structural Bioinformatics. (3 Credits)**

(3) A. Prerequisite: Senior standing, MAT 239, 254 and three hours from CSC 160, 174, 177, or 190. Mathematical and computational approaches to analyze and understand macromolecular structure data. Methods for protein structure determination, refinement, evaluation, comparison, and visualization. Protein surface representation and shape comparison. Structure databases.

**MAT 577. Introduction to Algebraic Coding Theory. (3 Credits)**

(3) A. Prerequisites: Senior standing; MAT 301, or both MAT 214 and departmental approval. Introduction to basic concepts of coding theory, linear codes, perfect codes, cyclic codes, BCH codes, and Reed Solomon codes. Additional topics as time permits. It is strongly recommended that students have completed a course in linear algebra and a course in proof writing.

## Statistics

### STA 215. Introduction to Statistical Reasoning. (3 Credits)

I, II. Prerequisite: Satisfaction of English and reading academic readiness indicators and either satisfaction of mathematics academic readiness indicators\* or concurrent enrollment in STA 215P. Introduction to descriptive statistics, normal distributions, correlation and linear regression, sampling, experiments, chance phenomena, one- and two-sample estimation and hypothesis testing, chi-square tests, and use of statistical software. Gen. Ed. E-2 [QR].

### STA 215L. StatLab for STA 215. (1 Credit)

A. Corequisite: STA 215. This optional lab is to accompany a regular lecture class in STA 215; topics will vary. 2 Lab.

### STA 215P. Quantitative Support for STA 215. (1 Credit)

(1) I, II. Corequisite: STA 215. Corequisite support for students concurrently enrolled in STA 215. Emphasis on prerequisite skills needed for statistics, such as real number sense and operations, equations, analyzing graphs, modeling, critical thinking, and use of statistical software. 2 Lab.

### STA 230. Probability and Statistics for Middle Grades Teachers. (3 Credits)

Prerequisite: MAT 112, 114, 211, or 234 with a minimum grade of "C". Pre- or Co-requisite: MAE 201. Sampling graphs, percentiles, measures of center and variability, mean absolute deviation, correlation, lines of best fit, probability, geometric probability, independence, simulations, contingency tables, counting, binomial uniform, and normal probability distributions, one-sample inference, manipulatives, presentations, technology.

### STA 260. Business Statistics. (3 Credits)

A. Descriptive statistics, probability, discrete and continuous distributions, normal distributions, sampling distributions, one- and two-sample estimation and hypothesis testing, correlation, linear regression, analysis of variance, business applications, and use of Excel.

### STA 270. Applied Statistics. (4 Credits)

I, II. Prerequisite: MAT 112 or 112B higher with a minimum grade of "C", or a Math SAT score of 23 or higher, or a Math SAT math score of 560 or higher. Descriptive statistics, probability, counting techniques, discrete and continuous distributions, binomial distributions, normal distributions, sampling distributions, one- and two-sample estimation and hypothesis testing, chi-square tests, correlation, linear regression, analysis of variance, and use of statistical software. Gen. Ed. E-2 [QR].

### STA 270L. StatLab for STA 270: \_\_\_\_. (1 Credit)

A. Prerequisite/Corequisite: STA 270. This optional lab is to accompany a regular lecture class in STA 270: topics will vary. 2 Lab.

### STA 340. Applied Regression Analysis. (3 Credits)

I, II. Prerequisite: STA 270 with a minimum grade of "C"; or STA 215 with a minimum grade of "B" and one of the following: MAT 112 or 112B or higher with a Grade of "C" a Math ACT score of 23 or higher, or a Math SAT score of 560 or higher; or departmental approval. Simple and multiple regression, model building, variable screening methods, detection and management of multicollinearity, residual analysis, logistic regression, classical time series analysis, and use of statistical software. Credit will not be awarded to students who have credit for STA 320.

### STA 349. Applied Learning in Statistics. (0.5-8 Credits)

I, II; (1-6) SUMMER ONLY. Prerequisite: departmental approval. Work in placements related to academic studies. Does not apply to major or minor requirements. Total hours: eight, associate; sixteen, baccalaureate. A minimum of 80 hours of employment is required for each semester hour of academic credit.

### STA 349A. Cooperative Study: Statistics. (0.5-8 Credits)

I, II. (1-6) SUMMER ONLY. Prerequisite: departmental approval. Work in placements related to academic studies. Does not apply to major or minor requirements. Total hours: eight, associate; sixteen, baccalaureate. A minimum of 80 hours of employment is required for each semester hour of academic credit.

### STA 349B. Cooperative Study: Statistics. (0.5-8 Credits)

Work in placements related to academic studies. Does not apply to major or minor requirements.

### STA 349C. Cooperative Study: Statistics. (0.5-8 Credits)

Work in placements related to academic studies. Does not apply to major or minor requirements.

### STA 349D. Cooperative Study: Statistics. (0.5-8 Credits)

Work in placements related to academic studies. Does not apply to major or minor requirements.

### STA 349E. Cooperative Study: Statistics. (0.5-8 Credits)

Work in placements related to academic studies. Does not apply to major or minor requirements.

### STA 375. Sampling Methods. (3 Credits)

A. Prerequisite: STA 270 with a minimum grade of "C"; or STA 215 with a minimum grade of "B", and one of the following: MAT 112 or 112B or higher with a minimum grade of "C" or a Math ACT score of 23 or higher, or a score of 560 or higher; or departmental approval. Basic concepts of sampling theory, simple random sampling, stratified random sampling, cluster sampling, systematic sampling, ratio and regression estimation, applications to surveys, and use of statistical software. Written and/or oral presentations required.

### STA 380. Nonparametric Statistics. (3 Credits)

Prerequisite: STA 270 with a minimum grade of "C"; or STA 215 with a minimum grade of "B" and one of the following: MAT 112 or 112B or higher with a Grade of "C" a Math ACT score of 23 or higher, or a Math SAT score of 560 or higher; or departmental approval. Simple, efficient nonparametric methods without normality assumptions. Tests, estimation of proportions, medians, two-sample location/dispersion, one and two-way layout, independence, regression, and use of statistical software. Credit will not be awarded to students who have credit for STA 501.

### STA 382. Probability for Actuaries. (1 Credit)

A. Prerequisite: STA 370 or 520. Review of elementary probability theory, univariate and multivariate probability distributions, moment generating functions, transformations, order statistics, and applications of probability concepts in a risk management context. Preparation for Exam P.

### STA 470. Applied Probability. (3 Credits)

Formerly STA 370. Prerequisites: Mat 244 of 244H or 254 or 254H; and STA 215 or 270; or departmental approval. Intuitive and axiomatic development of probability, set theory, counting techniques, conditional probability, Bayes Theorem, discrete distributions including univariate and bivariate cases, multinomial distributions, Markov Chains, and emphasis on applications. Credit will not be awarded to students who have credit for STA 370.

### STA 480. Seminar in \_\_\_\_. (1-3 Credits)

A. Prerequisite: departmental approval. Topic announced at the time of offering. May be retaken to a maximum of 12 hours, provided the topics are different.

**STA 485. Probability for Actuaries. (2 Credits)**

A. Formerly STA 385. Prerequisite: STA 470, MAT 520 or STA 520. Review of elementary probability theory, univariate and multivariate probability distributions, moment generating functions, transformations, order statistics, and applications of probability concepts in a risk management context. Preparation for Actuarial Exam P. Credit will not be awarded to students who have credit for STA 385.

**STA 495. Independent Work. (1-3 Credits)**

A. Prerequisite: departmental approval. Directed study/ research on a problem or area chosen in consultation with instructor. Final paper required. Student must have the independent study proposal form approved by faculty supervisor and department chair prior to enrollment. May be retaken to a maximum of six hours.

**STA 498. Statistics Capstone. (3 Credits)**

A. Prerequisite or corequisite: MAT 520 (C) or STA 520 (C), senior standing, Statistics majors only. Careers in statistics, advanced topics in statistics, statistical research, statistical consulting, written and verbal communication skills, use of presentation software, and use of statistical software. Credit will not be awarded to students who have credit for STA 498W.

**STA 498W. Statistics Capstone. (3 Credits)**

A. Prerequisite or corequisite: MAT 520 (C) or STA 520 (C), senior standing, Statistics majors only. Careers in statistics, advanced topics in statistics, statistical research, statistical consulting, written and verbal communication skills, use of presentation software, and use of statistical software. Credit will not be awarded to students who have credit for STA 498.

**STA 507. Seminar in Statistics:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: departmental approval. Topics vary with offering. May be retaken with advisor approval, provided that the topics are different. Credit toward degree requirements will depend on the course content.

**STA 520. Mathematical Statistics I. (3 Credits)**

I. Cross-listed as MAT 520. Prerequisites: STA 215 or 270. Prerequisite or Corequisite: MAT 254 or 254H. Descriptive statistics, discrete and continuous probability distributions for one and two variables, functions of random variables, sampling distributions, expectations and generating functions. Credit will not be awarded to students who have credit for MAT 520.

**STA 521. Mathematical Statistics II. (3 Credits)**

II. Prerequisites: MAT 239; MAT 520 or STA 520. A continuation of STA 520. Estimation theory, hypothesis testing, linear regression analysis of variance, and allied topics.

**STA 570. Quality Control & Reliability. (3 Credits)**

(3) A. Prerequisites: Senior standing, MAT 234 or 234H, and STA 340. Analysis of six sigma techniques, statistical analysis of process capability, statistical process control using control charts, quality improvement, acceptance sampling, and an introduction to product reliability.

**STA 575. Statistical Methods Using SAS. (3 Credits)**

A. Prerequisite: STA 270 with a minimum grade of "C"; or STA 215 with a minimum grade of "B", and one of the following: MAT 112 or 112B or higher with a minimum grade of "C" or a Math ACT score of 23 or higher, or a Math SAT score of 560 or higher; or departmental approval. Data set manipulation, application of statistical techniques in SAS, and statistical programming.

**STA 580. R and Introductory Data Mining. (3 Credits)**

A. Cross-listed as DSC 580. Prerequisite: STA 270 with a minimum grade of "C", or 215 with a minimum grade of "B", and CSC 170 or 174 or 189 or 190. Data set manipulation, application of statistical techniques in R, statistical programming, and data mining skills. Credit will not be awarded to students who have credit for DSC 580.

**STA 585. Experimental Design. (3 Credits)**

A. Prerequisites: STA 270 or departmental approval. Completely randomized designs, factorial experiments, multiple comparisons, model diagnostics, randomized blocks, latin squares, fixed and random models, nested-factorial experiments, 2<sup>f</sup> factorial experiments, and split-plot designs. Emphasis on applications and use of statistical software.