

# DEPARTMENT OF MATHEMATICS

## COLLEGE OF ARTS AND SCIENCES

### Faculty

**Bryan Dawson** (1998). Professor of Mathematics and Department Chair. B.S. and M.S., Pittsburg State University; Ph.D., University of North Texas.

**Richard Dehn** (1969). Associate Professor of Mathematics. B.S., University of Memphis; M.A.T., Purdue University; M.S., University of Arkansas, Additional study, University of Wisconsin, University of Arkansas, University of Missouri-Rolla.

**Chris Hail** (1995). Professor of Mathematics. B.S., Campbellsville College; M.A., Morehead State University; Ed.D., University of Kentucky.

**Dwayne Jennings** (1981). Associate Professor of Mathematics and Computer Science. B.S., Union University; M.S. (Mathematics) and M.S. (Computer Science), University of Memphis.

**Matt Lunsford** (1993). Professor of Mathematics. B.G.S., Louisiana Tech University; M.S., University of Nebraska; Ph.D., Tulane University.

**Don Rayburn Richard** (1983). Associate Professor of Mathematics. B.S., University of Memphis; M.A., University of Missouri; M.B.A., University of Colorado.

**Troy Riggs** (1993, 2000). Professor of Mathematics. B.S., University of South Dakota; M.A., and Ph.D., University of Nebraska-Lincoln.

### Mission Statement

Union's mathematics program seeks to further students in their quest for increased understanding of Creation and the created order and to equip students to serve God, church and society through excellence in thinking and the use of mathematics. We do this through a curriculum that develops the student's ability to think logically, analytically, and abstractly; to pursue a body of knowledge whose basis is independent of both empirical observation and culture; and to learn humility and a sense of wonder at the complexity, beauty, and applicability of mathematics.

### Student Awards

A **Departmental Award** is given to the senior who places first in the Major Field Test for Mathematics as partial fulfillment of MAT 498.

The **Wolfram Research Inc. Award** is awarded to a freshman calculus student chosen by the Department of Mathematics based upon demonstrated outstanding achievement, enthusiasm, ingenuity, and creativity in mathematics.

### Curriculum

The department offers a major in mathematics and minors in mathematics, mathematics with emphasis in statistics, and actuarial science. Students majoring in mathematics may select from the following tracks: mathematics, teacher licensure in mathematics for secondary education (grades 7-12), or actuarial science. The offerings of the major

provide a foundation for beginning graduate study in mathematics, for entry into mathematics-related work fields, and for teaching mathematics at the secondary level. Students majoring or minoring in mathematics begin their academic credit towards the major or minor with courses numbered MAT 205 or above. Students having a four-year high school mathematics program that included trigonometry should be able to begin the calculus sequence in their first semester.

#### I. Major in Mathematics—35 hours

- A. MAT 207, 208, 211, 212, 213, 315 and 498 are required.
- B. Select one: MAT 411, MAT 415.
- C. Select 9 hours from junior or senior MAT courses.
- D. Independent Study (MAT 495) or Departmental Special Study (MAT 395) may be used for 3 of the 9 hours required in C.
- E. Prerequisites: PHY 231, and CSC 115 or 255.

#### II. Teacher Licensure in Mathematics (Grades 7-12)

- A. Major requirements as shown above to include MAT 413.
- B. Professional Education: EDU 150, 250, 326, 422, 433; PSY 213, 318; SE 225.
- C. Completion of applicable portions of the Praxis II.
- D. For additional information, see the Assistant Dean for Teacher Education and Accreditation.

#### III. Minor in Mathematics—21 hours

- A. MAT 211 and 212 are required and one of: MAT 205, 207, 208, 213.
- B. CSC 115 or 255
- C. At least 6 hours of upper-level hours.
- D. The remaining must be 205 or higher.

#### IV. Minor in Mathematics with an Emphasis in Statistics—20 or 21 hours

- A. MAT 211 and 212, 208, 305, and 405
- B. One of: MAT 213, 314, 315; CSC 115 or 255.

#### V. Minor in Actuarial Science as earned with a Math Major—19 hours

- A. Prerequisites (applicable to major): MAT 211, 212, 213, 305, 315, 401, 402.
- B. ACC 211, 212; ECO 211, 212; FIN 320.
- C. ECO 411 or 412.
- D. MAT 400.

#### VI. Minor in Actuarial Science as earned with a Business Major and BSBA—21 hours

- A. Prerequisites (applicable to other requirements): ACC 211, 212; ECO 211, 212; FIN 320; ECO 411 or 412; MAT 208, 211; CSC 115 or 255. Note: In the BSBA core MAT 208 substitutes for MAT 114, and CSC 115 or 255 for 105.
- B. MAT 212, 213, 305, 315.
- C. MAT 400, 401, 402.

### Assessment of Majors

All senior mathematics majors must take the Major Field Test in mathematics as one requirement for MAT 498 (see below). Those majors completing a teacher licensure program are required to take the PRAXIS II.

## Student Organizations

Kappa Mu Epsilon, honor society in mathematics, selects students who have achieved standards of scholarship, professional merit, and academic distinction. A student must have completed 3 semesters' rank in the upper 35%, completed 3 courses in MAT, to include calculus, and have a minimum 3.0 Math GPA.

## Course Offerings in Mathematics (MAT)

( ) Hours Credit; F–Fall, W–Winter; S–Spring; Su–Summer

### @101. Fundamental Concepts (3) F, S

This course is designed to introduce the student to problem solving strategies and the real number system. Topics will include the whole numbers, integers, fractions and decimals, functions and coordinate geometry.

### @107. Mathematics for the Liberal Arts (3)F, S

This course is designed to introduce the student to the basic concepts of several areas of mathematics. Topics of focus will include counting techniques, descriptive statistics, probability and geometry.

### @\*111. College Algebra (3) F, W, S; Su As Needed

Prerequisite: Two years of high school algebra.

Topics include equations in two variables, functions, graphing techniques, systems of equations and inequalities, exponential and logarithmic functions, matrices, and the theory of polynomial equations.

### @\*112. Plane Trigonometry (3) S–As Needed

Prerequisite: MAT 111.

Topics include the definition of the trigonometric functions, radian measure, linear and angular velocity, graphing techniques, trigonometric identities and equations, the inverse trigonometric functions, and solving triangles.

### @114. Introduction to Statistics and Probability (3)

F, W, S; Su–As Needed

Prerequisite: Two years of high school algebra.

Descriptive statistics with introduction to inferential statistics. Topics include organization of data into frequency distribution tables and histograms, measures of central tendency, standard deviation, basic probability, continuous distributions through the normal distribution, introduction to sampling theory and hypothesis testing.

### @\*116. Precalculus (3) F; S–As Needed

Prerequisites: Two years of high school algebra and one of geometry.

An introduction to polynomial, exponential, logarithmic, and trigonometric functions and basic analytic geometry. This course is intended for students planning to take MAT 211 and is not recommended for students who have taken MAT 111 and/or 112.

**Sigma Zeta** is a national honorary science society for those who have completed 15 hours in natural science and math with a minimum GPA of 3.0 in these courses.

### @201. Applied Calculus (3) F–As Needed

Prerequisite: MAT 111 or its equivalent.

Topics include a review of algebra principles, development of differential calculus with an emphasis on applications of the derivative to business and biological sciences, and an introduction to integral calculus with elementary applications of the definite integral. Is not recommended for students that have taken MAT 211-12.

### 205. Discrete Mathematics (3) F–As Needed

Prerequisite: MAT 111 or its equivalent.

Topics include elementary logic, sets, proof techniques including induction, relations and graphs, recurrence relations, basic counting techniques, equivalence relations, Boolean algebra, and algebraic structures.

### 207. Transition Mathematics (3) S

Corequisite: MAT 212

An introduction to abstract mathematical reasoning, including reading and writing proofs. Topics include logic, types of proofs, set theory, functions and relations.

### 208. Statistics (3) F; S–As Needed

Prerequisite: MAT 201 or 211.

This is a calculus-based statistics course. Topics include descriptive statistics, probability theory, discrete and continuous random variables, common discrete distributions, the normal distribution, sampling distributions, and applications to confidence interval estimates and hypothesis testing.

### 211. Calculus and Analytic Geometry I (4) F, S

Prerequisite: Pass Calculus Readiness Test or MAT 116.

Topics include basic concepts of plane analytic geometry, functions, limits, differentiation of algebraic and trigonometric functions, applications of the derivative, the indefinite and the definite integral, and the fundamental theorem of calculus.

### 212. Calculus and Analytic Geometry II (4) F, S

Prerequisite: MAT 211.

Topics include integration by substitution, numeral integration, applications of the definite integral, the calculus of transcendental functions, techniques of integration, and the calculus of parametrized curves.

### 213. Calculus and Analytic Geometry III (4) F, S

Prerequisite: MAT 212.

Topics include infinite series, polar coordinates, vectors in three-space, functions of several variables, partial derivatives, multiple integrals, and line integrals.

**305. Statistical Methods (3) As Needed**

Prerequisite: MAT 208.

Parametric and non-parametric statistical methods with an emphasis on applications. Topics include correlation and regression, analysis of variance, Chi-square distribution, contingency tables, and applications to the social sciences, life sciences, and business.

**310. History of Mathematics (3) As Needed**

Prerequisite: MAT 212.

A survey of the major developments in the history of mathematics with special emphasis to the areas usually discussed in high school and undergraduate mathematics courses: geometry, algebra, trigonometry, and calculus.

**314. Differential Equations (3) S or As Needed**

Prerequisite: MAT 213.

Topics include linear first-order differential equations and applications, higher-order differential equations, and applications.

**315. Linear Algebra (3) S or As Needed**

Prerequisite: MAT 212.

Topics include systems of linear equations, matrices, determinants, linear transformations, diagonalization of matrices, and major applications to business and the sciences.

**320. Introduction to Complex Variables (3) As Needed**

Prerequisite: MAT 213.

Algebraic properties of the complex number system, complex transformations, analytic functions, complex integration, residues, and series representations of functions.

**360. Numerical Analysis (3) As Needed**

Prerequisite: CSC 115 or 255, MAT 207 and 213.

Numerical computations, roots of equations, simultaneous nonlinear and linear simultaneous equations, numerical integration and differentiation, and power series calculations.

**400. SOA Exam P Preparation (1) As Needed**

Prerequisite: MAT 213 and 305.

Application of calculus and statistics to risk management problems relevant to the Society of Actuaries first exam. Sitting for the SOA Exam P is required for successful completion of the course. Pass/Fail.

**401. Actuarial Mathematics I (3) As Needed**

Prerequisite: MAT 400

Measures of interest, annuities-certain, amortization schedules, sinking funds and bonds. Introduction to life tables, life annuities and life insurance.

**402. Actuarial Mathematics II (3) As Needed**

Prerequisite: 401.

Actuarial models, including survival models, stochastic processes, and loss models. Applications to insurance and annuity contracts.

**405. Mathematical Statistics (3) As Needed**

Prerequisites: MAT 305 and 212.

A calculus-based introduction to the theory of probability and statistics. Topics include conditional probability and independence, random variables, mathematical expectations, discrete and continuous distributions, central limit theorem, and sampling theory.

**411. Introduction to Analysis (3) F—Odd Years or As Needed**

Prerequisite: MAT 207 and 213.

A rigorous inquiry into sequences, limits, continuity, differentiation, and integration.

**413. College Geometry (3) F—Odd Years**

Prerequisite: MAT 207 and 212.

Topics include axiomatic foundations of Euclidean and non-Euclidean geometry, models for incidence geometries, and development of theorems in the geometries of the Euclidean plane and the hyperbolic plane.

**415. Abstract Algebra (3) F—Even Years**

Prerequisite: MAT 207 and 212.

An introduction to number theory, group theory, and ring theory. Topics include divisibility in the integers, permutation groups, homomorphisms, normal subgroups and quotient groups, LaGrange's Theorem, ideals, and polynomial rings.

**498. Mathematics Seminar (2) F**

Prerequisite: 20 hours of MAT course work and Senior standing.

The setting for administering the Major Field Test, for addressing those areas of mathematics for which prior assessment indicates the need for improvement, for providing seniors an opportunity to demonstrate their awareness of the abstract nature of mathematics and its unifying principles through oral and written presentations, and for discussion of current mathematical research. The course may be modified at the discretion of the department.

\* Six hours maximum may be applied toward graduation from MAT 111-2, 116.

@ Does not apply toward the major or minor.

**179-279-379-479. External Domestic Study Programs (1-3) As Needed**

All courses and their applications must be defined and approved prior to registering.

**180-280-380-480. Study Abroad Programs (1-4)**

All courses and their application must be defined and approved prior to travel.

**195-6-7. Special Studies (1-4)**

**295-6-7. Special Studies (1-4)**

Lower-level group studies which do not appear in the regular departmental offerings.

**395-6-7. Special Studies (1-4)**

Upper-level group studies which do not appear in the regular departmental offerings.

**495-6-7. Independent Study (1-4)**

Individual research under the guidance of a faculty member(s).

**497-8-9. Seminar (1-3)**

To be used at the discretion of the department.