

MATHEMATICS

(Society of the Cincinnati Foundation)

PROFESSORS **BOURDON**, DYMÁČEK, EVANS
DISTINGUISHED VISITING PROFESSOR HUMKE
ASSOCIATE PROFESSORS DRESDEN, FELDMAN,
McRAE, WEICKERT
ASSISTANT PROFESSORS CROWLEY, FINCH,
SIEHLER

MAJORS

A **major in mathematics** leading to a Bachelor of Arts degree requires the completion of at least 33 credits as follows:

1. MATH 221, 222, 311, 312, 321, 322
2. One course selected from CSCI 211, 313; ECON 220; MATH 218, 310, 333, 353; PHYS 112
3. 12 additional credits selected from mathematics courses numbered above 300.

Additional courses required as prerequisites for completion of the above include MATH 101 and 102, or their equivalents; furthermore, the course selected to fulfill requirement 2 above may have prerequisites.

A **major in mathematics** leading to a Bachelor of Science degree requires the completion of at least 51 credits as follows:

1. MATH 221, 222, 311, 312, 321, 322; PHYS 111, 112, 113, 114
2. CSCI 111 or 121
3. 15 additional credits selected from mathematics courses numbered above 300
4. Six additional credits selected from courses in biology, chemistry, computer science, engineering, geology, mathematics (numbered 200 and above), and physics, except courses excluded from degree programs in those subjects.

Additional courses required as prerequisites for completion of the above include MATH 101 and 102 or their equivalents.

MINOR

A **minor in mathematics** requires completion of 18 credits. A student may not complete both a major and a minor in mathematics. In meeting the requirements of this discipline-based minor, a student may not use more than nine credits used to meet the requirements of another major or minor.

1. MATH 102, 221, 222
2. Either MATH 311 and 312 or MATH 321 and 322
3. One other course at the 300 level in mathematics

HONORS: An Honors Program in mathematics is offered for well-qualified majors; see department head for details.

MATH 101: Calculus I (3)

An introduction to the calculus of functions of one variable, including a study of limits, derivatives, extrema, integrals, and the fundamental theorem. (FM, GE5b) *Staff.*

Fall, Winter

MATH 102: Calculus II (3)

Prerequisite: The equivalent of MATH 101 with C grade or better. A continuation of MATH 101, including techniques of integration, transcendental functions, and infinite series. (SC, GE5c) *Staff.*

Fall, Winter

MATH 118: Introduction to Statistics (3)

Prerequisite: MATH 101. Elementary probability and counting. Mean and variance of discrete and continuous random variables. Central Limit Theorem. Confidence intervals and hypothesis tests concerning parameters of one or two normal populations. (SC, GE5c)

Winter

MATH 121: Discrete Mathematics I (3)

A study of concepts fundamental to the analysis of finite mathematical structures and processes. These include logic and sets, algorithms, induction, the binomial theorem, and combinatorics. (FM, GE5b)

Fall, Winter

MATH 122: Discrete Mathematics II (3)

Prerequisite: MATH 121. A continuation of MATH 121. Applications of 121 include probability theory in finite sample spaces and properties of the binomial distribution. This course also includes relations on finite sets, equivalence classes, partial orderings, and an introduction to graph theory and enumeration. (SC, GE5c)

Offered in the winter term when interest is expressed and departmental resources permit.

MATH 171: Mathematics of Cryptography (4)

Prerequisite: MATH 101 or 121. The history and application of cryptography. Topics include private-key codes, the ENIGMA machine and other WWII codes, public-key codes, and the RSA system. Appropriate mathematics is introduced, as necessary, to understand the construction and use of these codes. Several assignments are themselves in code, and students must decipher them just to find out what the homework is. (SC, GE5c) *Dresden.*

Spring 2010 and alternate years

MATH 195: Special Topics in Contemporary Mathematics (4)

Prerequisite: MATH 101 or 121, depending on course topic. A selected mathematical topic of current widespread interest. (SC, GE5c)

Spring

MATH 218: Applications of Statistics (3)

Prerequisite: MATH 118, MATH 309, or INTR 202. Theory and applications of the General Linear Model, including analysis of variance and covariance, multiple regression, and experimental design.

Offered in the winter term when interest is expressed and departmental resources permit.

MATH 221: Multivariable Calculus (3)

Prerequisite: The equivalent of MATH 102 with C grade or better. Multivariable calculus, including motion in R^3 , parametric curves in R^n , differential calculus of functions from R^n to R and to R^m , multiple integrals.

Fall, Winter

MATH 222: Linear Algebra (3)

Prerequisite: MATH 221. Introductory linear algebra: systems of linear equations, matrices and determinants, vector spaces over the reals, linear transformations, eigenvectors, and vector geometry.

Winter

MATH 242: Vector Analysis (3)

Prerequisite: MATH 221. Vector differential operators: gradient, divergence, and curl. Path and surface integrals. Orientation. Calculus of differential forms. Theorems of Green, Gauss, and Stokes. Applications.

Offered in the winter term when interest is expressed and departmental resources permit.

MATH 301: Fundamental Concepts of Mathematics (4)

Prerequisite: Six credits of mathematics or a grade of at least B in MATH 102. An introduction to abstract methods in mathematical analysis and algebra.

Spring

MATH 303: Complex Analysis (3)

Prerequisite: MATH 221 or permission of the instructor. Algebra of complex numbers, polar form, powers, and roots. Derivatives and geometry of elementary functions. Line integrals, the Cauchy Integral Theorem, the Cauchy Integral formula, Taylor and Laurent Series, residues, and poles. Applications.

Winter 2011 and alternate years

MATH 309: Mathematical Statistics I (3)

Prerequisite: The equivalent of MATH 221 with C grade or better. Probability, probability density and distribution functions, mathematical expectation, discrete and continuous random variables, and moment generating functions.

Fall 2009 and alternate years

MATH 310: Mathematical Statistics II (3)

Prerequisite: MATH 309. Sampling distributions, point and interval estimation, testing hypotheses, regression and correlation, and analysis of variance.

Winter 2010 and alternate years

MATH 311: Real Analysis I (3)

Prerequisites: MATH 221 with C grade or better; MATH 301 is recommended. Basic properties of real numbers, elementary topology of the real line and Euclidean spaces, and continuity and differentiability of real-valued functions on Euclidean spaces.

Fall

MATH 312: Real Analysis II (3)

Prerequisite: MATH 311. Riemann integration, nature and consequences of various types of convergence of sequences and series of functions, some special series, and related topics.

Winter

MATH 321: Abstract Algebra I (3)

Prerequisites: MATH 222; MATH 301 is recommended. Groups, including normal subgroups, quotient groups, permutation groups. Cauchy's theorem and Sylow's theorems.

Fall

MATH 322: Abstract Algebra II (3)

Prerequisite: MATH 321. Rings, including ideals, quotient rings, Euclidean rings, polynomial rings. Fields of quotients of an integral domain. Further field theory as time permits.

Winter

MATH 332: Ordinary Differential Equations (3)

Prerequisite: MATH 221 with C grade or better. First and second order differential equations, systems of differential equations, and applications. Techniques employed are analytic, qualitative, and numerical.

Fall

MATH 333: Partial Differential Equations (3)

Prerequisite: MATH 332. An introduction to the study of boundary value problems and partial differential equations. Topics include modeling heat and wave phenomena, Fourier series, separation of variables, and Bessel functions. Techniques employed are analytic, qualitative, and numerical.

Winter

MATH 340: Classical Geometry (4)

Prerequisite: MATH 221. A survey of the world of geometry primarily for prospective high school teachers, featuring exposure to current computer technology in the field, construction of geometric models, and a historical and axiomatic development. Basic concepts are developed through non-Euclidean geometry.

Offered in the spring term when interest is expressed and departmental resources permit.

MATH 341: Geometric Topology (3)

Prerequisite: MATH 221. A study of the shape of space focusing on characteristics not detected by geometry alone. Topics are approached pragmatically and include point set topology of Euclidean space, map-coloring problems, knots, the shape of the universe, surfaces, graphs and trees, the fundamental group, the Jordan Curve Theorem, and homology.

Fall 2010 and alternate years

MATH 342: Modern Geometry (3)

Prerequisite: MATH 221. A survey of recent developments in geometry. Topics vary and may include such subjects as the geometry of curves and surfaces, singularity and catastrophe theory, geometric probability, integral geometry, convex geometry, and the geometry of space-time.

Winter 2011 and alternate years

MATH 353: Numerical Analysis (4)

Prerequisites: MATH 221 and 222. Solution of equations, polynomial approximations, interpolation and quadrature, and numerical solutions of differential equations.

Spring 2010 and alternate years

MATH 361: Graph Theory (4)

Prerequisite: MATH 122 or 222. Graphs and digraphs, trees, connectivity, cycles and traversability, and planar graphs. Additional topics selected from colorings, matrices and eigenvalues, and enumeration.

Spring 2011 and alternate years

MATH 365: Number Theory (3)

Prerequisite: MATH 301 or permission of the instructor. Topics include prime numbers, Euclidean algorithm, congruences, Chinese Remainder Theorem, Fermat's Little Theorem, Euler's Theorem, arithmetic functions, Euler's phi function, perfect numbers, the quadratic reciprocity law, continued fractions, and other topics as time and student interest permit.

Winter 2010 and alternate years.

MATH 369: The Mathematics of Puzzles and Games (4)

Prerequisite: MATH 322. The application of mathematics to puzzles and games. A brief survey on the designs of tournaments. The puzzles and games include but are not limited to the Rubik's Cube, poker, blackjack, and peg solitaire. *Dymáček.*

Spring 2010 and alternate years

MATH 383: Seminar (3)

Prerequisite: Permission of the department. Readings and conferences for a student or students on topics agreed upon with the directing staff. May be repeated for degree credit with permission and if the topics are different. *Staff.*

Fall, Winter

Note: Seminar and research offerings are contingent upon the demonstrated need and aptitude of the student for independent work in mathematics and upon the availability of departmental resources.

MATH 401, 402, 403:**Directed Individual Study (1,2,3)**

Prerequisite: Permission of the department. Individual conferences. May be repeated for degree credit with permission and if the topics are different.

MATH 421, 422, 423, 426:**Directed Individual Research (1,2,3,6)**

Prerequisite: Permission of the department. Directed independent work in mathematics, especially for honors candidates. May be repeated for degree credit with permission and if the topics are different.

MATH 493: Honors Thesis (3-3)

Prerequisites: Honors candidacy, senior standing.

Fall-Winter

Military Engineering—For qualified students who may request it, a course in fortifications, gunnery, and ballistics will be offered.

MEDIEVAL AND RENAISSANCE STUDIES (MRST)

CORE FACULTY:

PROFESSORS BAILEY, BENT, BROWN, CAMPBELL, CRAUN, CROCKETT, MARKS, RADULESCU, SANDERS, SESSIONS, SPICE
ASSOCIATE PROFESSORS PETERSON*, FRÉGNAC-CLAVE, KOSKY
ASSISTANT PROFESSORS GERTZ, HATCHER, JIRSA, JOHNSON, PICKETT, PRAGER

MAJOR

A major in Medieval and Renaissance Studies leading to a Bachelor of Arts degree requires completion of at least 33 credits as follows:

1. Students must complete one of the following language sequences:
 - a. Six credits at the third-year level in French, German, Italian, Latin, Russian, or Spanish
 - b. The FL or GE2 requirement (i.e. qualified to enter third-year study) in French, German, Italian, Latin, Russian or Spanish and complete the first year of study in a second of these languages
2. MRST 110 (also, HIST 100 and 101 and REL 101 and 102 are strongly recommended)
3. 27 credits chosen from courses in the following four areas. Majors must complete four courses in one area, two courses in two other areas, and one course in the fourth area.
 - a. *History and History of Science:* HIST 170, 201, 202, 203, 204, 217, 305; PHYS 150; and, when appropriate, HIST 229, 395, and 403; INTR 296; MRST 395, 403; PHYS 403; and ROML 295
 - b. *Literature:* ENGL 240, 250, 311, 312, 313, 318, 319, 320, 326, 330; GERM 318; LATN 327; LIT 255; SPAN 211, 220, 320, 322; and, when appropriate, ENGL 299, 380, 403; FREN 341, 403; GERM 395, 403; INTR 296; ITAL 403; LIT 295, 395; MRST 395, 403, ROML 295; and SPAN 397, 403
 - c. *History of Ideas:* HIST 306; PHIL 221 (CLAS 221), 222; REL 151, 215, 250, 271, 282, 283, 287; and, when appropriate, FREN 341; HIST 395, 403; INTR 296; MRST 395, 403; PHIL 395, 403; POL 396, 403; REL 260, 350, 403; and ROML 295
 - d. *Fine Arts:* ARTH 253, 254, 255, 256, 285, 350, 353, 354, 355; MUS 201, 331; and, when appropriate, ARTH 394, 403; INTR 296; MRST 395, 403; MUS 374, 423; and ROML 295
4. MRST 473 or 493 (3-3).

HONORS: An Honors Program in Medieval and Renaissance Studies is offered for qualified students; see the program head for details.

**Head of the Medieval and Renaissance Studies major*