

# MATHEMATICS AND COMPUTER SCIENCE

Professor Coulliette, Chair  
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The Department of Mathematics and Computer Science at Asbury College has a strong commitment to a program of quality. The curriculum offers the student both depth and breadth of mathematics and application content, and a variety of introductory computer science courses. Three majors and three minors are available.

1. The COMPUTATIONAL MATHEMATICS MAJOR prepares the student to enter a career in industry, government, or business immediately upon graduation or to enter graduate school in computational science, or related areas of applied mathematics such as statistics, management science, operations research, actuarial science or computational biology. This major couples a strong emphasis on applied mathematics with the computational and programming skills necessary to solve practical problems. These skills are in high demand in the private sector and in government employment. The Computational Mathematics major is designed to allow the student flexibility in choosing a minor area of study as an application of the computational and mathematical skills learned in Department courses. Suggested minors range from the sciences (physics, chemistry, computer science or biology) to business management to art/media communications.

2. The MATHEMATICS MAJOR prepares the student for graduate study in mathematics, mathematical physics, or a related area that relies heavily upon theoretical mathematics. Eventual employment opportunities for persons with this background include teaching and research at the college or university level or being a member of a research team in government or industry. The Department has a rich history of graduates who have been successful in graduate school and subsequent academic and research careers.

3. The program content of the MATHEMATICS GRADES 8-12 MAJOR follows the recommendations of the National Council of Teachers of Mathematics and the Mathematical Association of America and meets teacher certification requirements in most states. Teachers of mathematics in both public and private middle and high schools are very much in high demand.

4. In recent years, the need for additional analytical and technical skills in financial and risk analysis has grown significantly. The technical nature of modern financial and economic analysis requires a student with a strong mathematical and computational background in addition to strong skills in business and economics.

The FINANCIAL MATHEMATICS MAJOR is designed to provide the student with these skills. The marketplace is also demanding this new combination of skills. Alumni and friends of Asbury College have advised that the need for technically savvy analysts is large and growing. Professional opportunities for actuaries, a prototype occupation for financial mathematics, are always near the top of employment projections. The continued spread of free-market economies, furthermore, increases the potential for these graduates to have international impact in an environment that seeks those who have a worldview shaped by the classical liberal arts and complemented by cutting-edge financial analysis.

### **Engineering**

Asbury College has contracted a 3 - 2 Dual Degree Program in Engineering in cooperation with the University of Kentucky. A student enrolling in this program would take courses at Asbury for three years. While this is intended as a 3-2 program, some students find it necessary to extend their studies over 6 years. Engineering courses (leading to one of seven possible engineering degrees) would be taken primarily the fourth and fifth years on the UK campus. The student would receive a B.A. in Engineering Mathematics (a major offered only to students in this program) from Asbury College upon satisfactory completion of the fourth year. At the end of the fifth year, the student would receive a B.S. in one of seven engineering fields from UK. These fields include: agricultural, chemical, civil, electrical, mechanical, and mining engineering, and materials science and engineering. A minimum GPA of 2.5 must be maintained to participate in these programs. In some cases an engineering program has a higher GPA requirement. Please consult the department chair for more information.

**COMPUTATIONAL MATHEMATICS** (51 hour major + general education + electives)

CSC 121, 122; MAT 181, 182, 241, 252, 271, 281, 351, 352, 442, 475, 482; PHY 211, 212.

**ENGINEERING MATHEMATICS** (78 hour major + general education + electives  
CHE 121, 122; CSC 121; MAT 181, 182, 252, 271, 351, 352; PHY 211, 212; PSY 100; SOC 100; 3 hours from HIS 351, HIS 352; MIS 330, SPN 322; 4th year at the University of Kentucky--27 hours in chosen engineering major, with 18 at 200 level or above. (Requires a 2.50 cumulative grade point average.)

**FINANCIAL MATHEMATICS** (50 or 54 hour major + general education + electives)

CSC 121, 122; ECN 272, 273, 372, 472; MAT 181, 182, 252, 271, 281, 474

Choose one area of concentration:

A. ACTUARIAL SCIENCE: BM 311; MAT 351; and 6 hours from: ACC 361, BM 321, 331, 451, 452, MAT 352

B. INTERNATIONAL ECONOMICS: ECN 471, 473; MAT 241, 435 (1); and 6 hours from: BM 321, 451, 452; MAT 351, 352, 481

**MATHEMATICS** (54 hour major + general education + electives)

CSC 121, 122; MAT 181, 182, 241, 252, 271, 351, 352, 471, 472, 475, 481, 482; PHY 211, 212.

**MATHEMATICS GRADES 8-12** (72-73 hour major + general education + electives)

CSC 113 or 121, ED 200, 210, 220, 240, 320, 385, 405, 410, 420, 470; MAT 152, 181, 182, 232 or 281, 241, 271, 342, 362, 462; MAT 371 or 471.

**MATHEMATICS** (21 hour minor)

MAT 152, 181, 182, 252, 271, 475, plus 3 hours MAT 200 or above.

## **COMPUTER SCIENCE COURSES**

**CSC 113 (4) Programming in Java**—An introduction to the object oriented programming language, Java. Focuses on problem solving, algorithm development, and designing, coding, testing, and documenting a program using standard programming techniques. Three lecture periods and one laboratory period per week. (alternate years)

**CSC 121 (4) Computer Science I**—Focuses on problem solving and algorithm development, learning a high-level language, how to design, code, test, and document a program using standard programming techniques. Three lecture periods and one laboratory period per week.

**CSC 122 (4) Computer Science II**—Continuation of CSC 121. Further development of programming skills, algorithmic analysis, elementary data structures. Three lecture periods and one laboratory period per week. Prerequisite: CSC 121.

**CSC 391 (1-3) Directed Study**—A study of some area of computer science not covered in other courses. Offered based on demand and availability of teaching staff. Prerequisite: permission of instructor. Contract.

**CSC 393 (1) Seminar**—Discussion of selected topics. May be offered in conjunction with other departments or as a separate course primarily for math or computer science students.

## **MATHEMATICS COURSES**

**MAT 100 (3) Introduction to Problem Solving**—Basic arithmetic and algebra skills set in the context of practical problem solving. Includes basic mathematical modeling and computing tools for setting up and solving problems in a variety of applications; measurement, linear models and equations, polynomials; use of TI-83 graphing calculator.

**MAT 111 (3) College Algebra**—Review of fundamental concepts of algebra including radicals, exponents, products and factoring. A study of equations and inequalities, and functions and graphs including polynomial and rational functions. Prerequisite: MAT 100 or its equivalent.

**MAT 112 (3) Precalculus**—Emphasizes a strong working knowledge of logarithmic and trigonometric functions. A major review of algebra with emphases on functions. Includes a preview of calculus. Prerequisite: MAT 111 or its equivalent.

**MAT 120 (3) Concepts of Mathematics and Technology**—Integrated mathematics and computer science course that presents a survey of topics emphasizing problem-solving and practical calculation skills related to logic, set theory, probability, statistics, and finance. Prerequisite: MAT 100 or ACT/SAT Math score of 19/460 or higher.

**MAT 131 (3) Finite Mathematics for Business**—Mathematics of finance, systems of equations, matrices, linear programming, and probability with applications to business and economics. Prerequisite: MAT 100 or ACT/SAT Math score of 21/480.

**MAT 132 (3) Calculus for Business**—Differential and integrative calculus with applications to business and economics.

**MAT 152 (3) Discrete Mathematics**—An introduction to topics in discrete mathematics of relevance to both mathematics and computer science majors, including: logic and sets, combinatorics, algorithms and recursion, graphs and trees, Boolean circuits, and formal languages. Prerequisite: MAT 100 or ACT/SAT Math score of 21/480.

**MAT 162 (3) Elementary School Mathematics I**—An emphasis on the skills and concepts related to the number systems of whole numbers through rational numbers. Problem solving, guided discovery, manipulatives, communication, (written and verbal), applications (connections), and technology will be incorporated. Prerequisite: MAT 100

**MAT 181, 182 (4 each) Calculus I, II**—An innovative course designed to teach the standard topics of calculus within the framework of applications. The emphasis is on seeing how calculus can be used in a large variety of settings, while the mechanics of arithmetic and algebraic computations are performed using calculators and computers. Derivatives and integrals of algebraic and transcendental functions in one and several variables are covered, as are introductory vector methods and infinite series. Prerequisite: MAT 112 or its high school equivalent.

**MAT 232 (3) Probability and Statistics**—An introduction to the basic concepts of statistics including the organization and descriptive analysis of data, probability, sampling distributions, hypothesis testing, and simple regression and correlation. Prerequisite: MAT 181.

**MAT 241 (3) Logic and Sets**—A study of the language of logic and of the theory of sets with their applications to various content areas of mathematics for the purpose of helping the student acquire an ability to construct mathematical proofs. Prerequisite: MAT 181.

**MAT 252 (3) Differential Equations and Modeling**—A first course in the quantitative solution of differential equations, including first-order equations, second- and higher-order linear equations, and power series solutions. There will be an emphasis throughout the course on the application of differential equations to various real-world problems. Prerequisite: MAT 182.

**MAT 261 (3) Elementary School Mathematics II**—An emphasis on the notions and concepts related to two- and three-dimensional geometry. Problem solving, guided discovery, manipulatives, communication (written and verbal), applications (connections), and technology will be incorporated. Two lecture periods and one laboratory period per week. Prerequisite: MAT 162.

**MAT 262 (3) Elementary School Mathematics III**—An emphasis on the concepts related to the real number system, elementary probability and statistics, and consumer mathematics. Problem solving, guided discovery, manipulatives, communication (written and verbal), applications (connections), and technology will be incorporated. Two lecture periods and one laboratory period per week. Prerequisite: MAT 261.

**MAT 271 (3) Linear Algebra**—A study of linear algebra, including vector spaces, matrices, determinants, inner products, linear transformations, and eigenvalues and eigenvectors. Prerequisite: MAT 182.

**MAT 281 (3) Probability**—Calculus-based introduction to probability including distributions of discrete and continuous random variables, expected values, and the Central Limit Theorem. Prerequisite: MAT 182.

**MAT 342 (1) History and Foundations of Mathematics**—A study of the history and foundations of mathematics to the end of the nineteenth century. Prerequisite: MAT 182 (alternate years).

**MAT 351, 352 (3 each) Applied Mathematics I, II**—A contemporary approach to applied mathematics whose central topics are discrete and continuous mathematics, linear algebra and differential equations. Numerous applications from science and engineering are covered along with the associated algorithms, always stressing a

consistent underlying mathematical framework. Equilibrium problems, Fourier techniques, analytical methods, initial-value problems, network flows and combinatorics, and optimization are possible topics. Prerequisite: CSC 112 or 121, MAT 252, 271.

**MAT 362 (4) Modern Geometry**—Designed for preservice middle and secondary teachers of mathematics. A study is made of Euclidean and non-Euclidean geometries using technology and hands-on experiences to generalize from example to theory. Prerequisite: MAT 241. (alternate years)

**MAT 371 (4) Algebraic Structures**—Introduces algebraic structures including groups, subgroups, rings, fields and integral domains. Special emphasis is placed on the real number system. The course includes a brief introduction to number theory. Also, a systematic review of Algebra I, Algebra II and Precalculus are conducted in a manner appropriate to Middle School and High School Teachers. Enrollment requires approval of the department chair. (on occasion)

**MAT 391 (1-3) Directed Study**—An advanced study of select problems. Prerequisite: 9 hours of MAT in courses numbered 300 or above and a 3.00 gpa in MAT courses. Not more than four hours may apply toward graduation. Contract.

**MAT 393 (1) Seminar**—Discussion of selected topics. May be offered in conjunction with other departments or as a separate course primarily for math or computer science students.

**MAT 432 (3) Financial Statistics**—Application of statistical methods in finance and economics. Topics include single and multivariate regression analysis, integrated methods, moving average models, autoregression models, time series analysis, ARIMA and ANOVA models. Prerequisite: MAT 232. (Alternate years.)

**MAT 435 (1-3) Financial Mathematics Internship**—In consultation with program faculty, a student will be placed in an internship in the business, finance or insurance industry. The student will maintain contact with the faculty sponsor and produce a paper or presentation of the work done during the internship experience. Contract.

**MAT 442 (3) Numerical Analysis**—A study of numerical methods concerned with the formulation of mathematical problems so that they may be solved using computers. Topics include rootfinding, interpolation, integration, and the solution of linear systems and differential equations. Prerequisites: MAT 252, 271 and CSC 122. (alternate years)

**MAT 462 (3) Topics in Secondary Mathematics**—Designed for preservice middle and secondary school teachers of mathematics. Topics of the grades 5-12 mathematics curriculum reconsidered from the perspective of understanding, connecting, and explaining via manipulative and computer software.

**MAT 471, 472 (3 each) Abstract Algebra I, II**—A study of groups, subgroups, homomorphisms and isomorphisms, rings and ideals, fields, extension of fields, finite fields, sylow theorems, Galois theory, and Boolean algebras. There is an integrated emphasis on applications. Prerequisite: MAT 241. (472 offered alternate years)

**MAT 474 (1) Financial Mathematics Senior Capstone**—Focuses on how to use financial mathematics skills to penetrate and impact the cultural setting of corporate leaders in the U.S. and overseas. Requires a paper which synthesizes the student's vision of how financial mathematics may be used for the Kingdom of God. Paper will be reviewed by a panel of people from both inside and outside the college who will then administer an oral examination to the student. Requires at least one professional interview with a senior executive, academician, or politician.

**MAT 475 (1) Senior Seminar**—This course will consist of a series of projects, many of which are chosen by students, on the basis of evaluative procedures and career plans. Most projects will involve class presentations, and projects that integrate several topics will be particularly encouraged.

**MAT 481 (3) Real Analysis**—A detailed examination of the analytic foundations of calculus. Topics include sequences, limits, continuity, differentiation, Riemann integration, and an introduction to topology. Prerequisite: MAT 241. (alternate years)

**MAT 482 (3) Complex Analysis**—The first course in the extension of calculus to complex numbers. Topics include the concept of analytic functions, the Cauchy-Riemann equations, Cauchy's theorem and formula, power series, the calculus of residues and the evaluation of definite integrals, conformal maps, and Riemann surfaces. Prerequisite: MAT 252, 271. (alternate years)