

Department of Mathematics and Computer Science

College of Arts and Sciences

Faculty

Bryan Dawson (1998). Associate 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.

Stephanie Edge (1996). Associate Professor of Computer Science. A.S., Middle Georgia College; B.S., West Georgia College; M.S., Georgia State University; M.Div., Southern Baptist Theological Seminary.

Chris Hail (1995). Associate 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.

James Kirk (2001). Assistant Professor of Computer Science. B.M., Union University; M.M. and M.A., Indiana University; Ph.D., University of Louisville.

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

116 **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). Associate Professor of Mathematics. B.S., University of South Dakota; M.A., and Ph.D., University of Nebraska-Lincoln.

G. Jan Wilms (1992). Professor of Computer Science, Associate Dean of the College of Arts and Sciences, and Coordinator of Computer Science. B.A., Katholieke Universiteit Leuven, Belgium; M.A. (English), University of Mississippi; M.S. (Computer Science), University of Mississippi; Ph.D. (Computer Science), Mississippi State University.

The Department of Mathematics and Computer Science offers majors in mathematics, computer science and digital media studies. Minors are offered in mathematics, mathematics with statistics emphasis, computer science, computer information systems and actuarial science.

Student Awards

The Academic Excellence Medal is awarded to the graduating senior with the highest average in the major provided the average is not less than 3.5. Before Awards Day, the student must have completed at least 15 credit hours in the major at Union University, exclusive of pass/fail courses. If no major is eligible, the medal will be given to the minor meeting the minimum requirements.

Departmental Awards are given to the 2 seniors who place first in the Major Field Test for Mathematics and Computer Science respectively as partial fulfillment of 498.

First Year Programming Award is awarded to a computer science student by The Department of Mathematics and Computer Science. A student is selected for excellence and expertise in first year programming courses.

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

Mathematics

The mathematics curriculum provides study toward the major in mathematics in either the B.S. or the B.A. degree program. The offerings for the major will provide a basic foundation for beginning graduate study in mathematics, for entry into work in fields relating to mathematics, and for teaching mathematics at the secondary level.

The curriculum also provides courses in mathematics which support studies in the natural and the social sciences, in elementary school teacher preparation, in business studies, and in computer science. Students with a four-year high school mathematics program, including trigonometry, should be able to begin the calculus sequence in their first semester. Placement in calculus is based on the ACT scores and the high school record. College Algebra assumes at least two years of high school algebra, and Intermediate Algebra requires one year of high school algebra and is offered for those people not ready for College Algebra.

Students majoring or minoring in mathematics will begin their credit in the calculus courses. Algebra and trigonometry may be needed as background but do not satisfy requirements for the major or minor.

I. Major in Mathematics—35 hours

- A. MAT 205, 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

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 Director of Teacher Education.

III. Minor in Mathematics—21 hours

- A. MAT 211 and 212 are required and one of: MAT 208, 205, 213; CSC 115.
- B. At least 6 hours of upper-level work is required with no more than one departmental special study allowed and no independent study allowed.
- C. 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.

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; ECF 211, 212, 323.
- C. ECF 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; ECF 211, 212, 323; ECF 411 or 412; MAT 208, 211; CSC 115. Note: In the BSBA core MAT 208 substitutes for MAT 114 and CSC 115 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 is a specialized honor society in Mathematics. The chapter's members are selected from students of mathematics 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 mathematics, to include calculus, and have a minimum 3.0 Math GPA.

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. Membership advantages include recognition for achievements by the Sigma Zeta Honor Award, participation in nationally recognized research projects, and a means of cooperation in similar areas by students of different colleges.

Course Offerings in Mathematics (MAT)

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

@100. Intermediate Algebra (3) As Needed

Topics include exponents, radicals, factoring, linear equations, quadratic equations, and system of equations. This course is for the student who has taken only one year of high school algebra or its equivalent; others may enroll only with permission of the department. Does not apply toward the Core math requirement.

@101. Fundamental Concepts (3) F, S

118 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, ratio and proportion, percents and functions.

@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 including algebra, geometry, trigonometry, probability, and descriptive statistics.

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

Prerequisite: Two years of high school algebra or MAT 100.

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 or MAT 100.

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.

@201. Calculus for Business/Social Sciences (3) 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 social sciences, and a brief 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) S, W 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.

208. Statistics (3) F; S—As Needed

Prerequisite: MAT 111.

Topics include descriptive and inferential statistics, probability theory, binomial and normal distributions, hypothesis testing, linear correlation and regression.

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

Prerequisite: MAT 111 and 112, or 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.

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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 As Needed

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) S or 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. Corequisite: MAT 205.

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) F—Even Years or 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, MAT 205 and 213.

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

400. SOA Course I Exam Preparation (1) As Needed

Prerequisite: MAT 213 and 305.

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

401. Actuarial Mathematics I (3) As Needed

120 Prerequisite: MAT 400

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

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 & 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 205 and 213.

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

413. College Geometry (3) F—Odd Years, Su—Even Years as Needed

Prerequisite: MAT 205 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 205 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.

* A maximum of 6 hours MAT credit may be earned toward graduation from 111-2, 116.

® Does not apply toward the major or minor.

Computer Science

The department offers four plans of study: Computer Science major, Digital Media Studies major, Computer Science minor, and Computer Information Systems minor.

Upon completion of the Computer Science Major, the student will have an understanding of and an appreciation for the interrelation of the 5 main areas of study in Computer Science: elements and architecture, programming concepts and languages, algorithms, data structures, and computer theory. The major emphasizes the practical application of basic concepts from each; therefore, the graduate will be able to continue study in Computer Science at the graduate level, or enter the job market.

The Digital Media Studies major is an interdisciplinary program joining Art, Communication Arts, and Computer Science. Its purpose is to produce a student aesthetically, theoretically, and technologically trained and capable of excellence in the relatively new area of the design, production, and implementation of digital communications media. Included are such areas as web page design, digital visual and aural communications strategies and theory, interactive media design, media programming, digital presentation techniques, and technological advances in digital communications.

The Computer Science Minor is intended for students interested primarily in pursuing a career in computer science or related field immediately upon graduation.

The Computer Information Systems Minor will provide the student with a general understanding of analysis, design, and implementation of applications via third- and fourth-generation programming languages and pre-written packages. This minor is intended for the student expecting to use computers in a job-supportive mode.

Neither CSC 105 nor 245 nor any Management Information Systems (MIS) course is applicable to any major/minor in the Math and Computer Science Department.

I. Major in Computer Science—41 hours

- A. Required: CSC 115, 125, 205, 220, 235, 255, 260, 311, 321, 365, 425, 455, 498.
- B. Select one: CSC 335, 360, 395, 411, 465, 485.
- C. Prerequisites: MAT 205, 211-2, 315.

II. Digital Media Studies Major

- A. Core requirements for all emphases—39 hours
 - 1. ART 120, 221, 231, 345.
 - 2. COM 220, 320, 365, 419.
 - 3. CSC 115, 321, 360, 365.
 - 4. Digital Media Studies Seminar 490.
- B. Computer Science Emphasis requirements—23 hours

1. CSC 125, 220, 235, 255, 335, 498.
 2. Select two courses: CSC 395, 411, 425, 455.
 3. Prerequisite: MAT 205.
- C. Art Emphasis—(28 hours) and Communication Arts Emphasis (24 hours)
See the respective department for details.

III. Minor in Computer Science—21 hours

- A. Required: CSC 115, 125, 220, 235, 260, 311.
- B. One additional upper level CSC course other than 490 or 498.
- C. Prerequisite: MAT 205.

IV. Minor in Computer Information Systems—21 hours

- A. Required: CSC 115, 125, 235.
- B. Select 4: CSC 321, 360, 365, 395, 411.

Assessment of Majors

All senior computer science majors must take the Major Field Test in computer science as one requirement for CSC 498 (see below).

Student Organizations

The ACM (Association for Computing Machinery) Student Chapter is composed of students who are interested in today’s world of computing. The club promotes an increased knowledge of the science, design, development, construction, languages, and applications of modern computing machinery. It provides a means of communication between persons interested in computing machinery and their applications.

Course Offerings in Computer Science (CSC)

() Hours Credit: F-Fall; W-Winter; S-Spring; Su-Summer

122 105. Survey of Microcomputing Applications (3) F, S

An introduction, for the non major /minor, to computers and their applications. A study of types of hardware associated with computer systems and how computers function, with an emphasis on the use of applications programs for microcomputers. Software packages will include word processing, an electronic spreadsheet, a database management system and an internal component. Cannot be earned for credit after 115.*

115. Computer Science: Introduction & Overview (3) F, S

An introductory course which exposes majors/minors to the breadth and interrelationships of future courses in the field and empowers students of other majors for a continuous exploration of today’s technical society. A language-independent overview of hardware and software with emphasis on problem solving and algorithm development. Cannot be earned for credit after 105 without departmental approval.*

*Either 105 or 115 apply to the B.S. specific core, but not both.

125. Computer Science I: Programming in Java (4) F, S

Prerequisite: CSC 115.

Basic concepts of problem solving, algorithm design and analysis, abstract data types, and program structures. GUI development will be introduced and the object-oriented programming paradigm will be emphasized. Students will design, implement, debug, test and document programs for various applications.

205. Computer Science II: Algorithms & Data Structures (3) F

Prerequisites: CSC 125, MAT 205. Corequisite: MAT 212.

A study of the complexity of algorithms and advanced data structures, including trees and graphs. Tools for analyzing the efficiency and design of algorithms, including recurrence, divide-and-conquer, dynamic programming, and greedy algorithms.

220. Computer Repair and Maintenance (3) S

Prerequisite: CSC 115.

A hands-on approach to competence in configuring, installing, diagnosing, repairing, upgrading and maintaining microcomputers and associated technologies. The course covers both core hardware and OS technologies.

235. Computer Ethics (2) S

Major social and ethical issues in computing, including impact of computers on society and the computer professional's code of ethics.

245. FORTRAN (3) As Needed

Prerequisite: CSC 115 and MAT 211.

Structures of FORTRAN will be studied: statements, subprograms, simple variables, arrays, and files. Design, coding, and testing of scientific problems will emphasize these structures. In addition, various implementations will be discussed.

255. Programming in C (3) S

Prerequisites: CSC 115.

Introduces the procedural programming paradigm using ANSI C.

260. Digital Systems (3) F

Prerequisite: CSC 125, CSC 220, and MAT 205.

Binary codes, Boolean algebra, combinational logic design, flip-flops, counters, synchronous sequential logic, programmable logic devices, MSI logic devices, adder circuits.

311. Computer Architecture (3) S

Prerequisite: CSC 260.

Introduction to the architecture of stored-program digital computer systems including processor and external device structures and operation, machine operations and instructions, and assembly language concepts and programming.

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321. Database Management Systems (3) F

Prerequisites: CSC 115 and Junior standing.

A hands-on approach to the design of databases: conceptual design using the E-R model and logical design using the relational model. The architecture of a database application is discussed including the 3-tiered model and web access. Queries, forms, reports and application general will be studied by implementing them in a client-server environment.

335. Computer Graphics (3) F—Even Years

Prerequisites: CSC 255; Recommended prerequisite: MAT 315.

This course is designed to investigate a wide range of computer graphics via programming techniques. Topics included in the course will be graphic display theory, graphic techniques, applications, and hardware.

360. Web Building & Site Management (3) F

Prerequisites: CSC 115. Recommended Prerequisite: CSC 125, 321.

Fundamental concepts of web site development and management, graphical web-building tools, multi-level site planning and construction, navigation schemes, client- and server-side scripting, basic interactivity, information organization, web site management, and the delivery of basic multimedia content.

365. Data Communications and Networking (3) S

Prerequisite: CSC 115 and Junior standing.

Introduction to the hardware and software components of computer data communications and networking. Emphasis is on practical, hands-on set-up, and administration of a LAN, peer-to-peer networking, and the TCP/IP protocol. Topics include routing, shared file and application access, remote printing, and security.

411. Systems Analysis (3) As Needed

Prerequisite: CSC 321.

Process of designing computer-based systems for business applications, tools and techniques of systems development and management, advantages and disadvantages of conversion from existing to new systems will be discussed.

425. Operating Systems (3) F

Prerequisites: CSC 220, 255 and 365. Recommended prerequisite: CSC 311.

Systems resource management: brief historical overview and case studies; discussion of multi-tasking and related concepts of scheduling, interprocess communication and mutual exclusion/deadlock; overview of file management and memory management (virtual memory, paging, swapping, and segmentation). Theory is augmented by detailed study of implementation of an existing operating system.

455. Programming Languages (3) S

Prerequisite: CSC 255.

Issues in programming language design, specification, and implementation: overview and comparison of major contemporary languages; analysis of translation process (interpreters and compilers) with focus on grammars and Chomsky hierarchy; investigation of data representation and binding, and of sequence control, including discussion of logic and object oriented paradigms. Theory is augmented by the implementation of a tokenizer and parser for a simple language.

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465. Formal Language (3) F—Odd Years

Prerequisites: CSC 255 and MAT 315. Recommended prerequisite: CSC 455.

Theoretical foundations of computer science including formal languages and automata, parsing of context-free languages, Turing machines, computability and complexity.

485. Internship in Computer Science (3) As Needed

Prerequisite: CSC 205, 220, 235 and one of: 321, 360, 365.

Selected students are assigned as interns to obtain supervised practical work related to the CS discipline at a business or non-profit organization.

490. Digital Media Studies Senior Seminar (3) F, S

Prerequisite: Taken in Senior Year. Reciprocal credit: ART/COM 490.

Capstone course for DMS majors to bring the emphases together for exposure to the variety of fields of digital media and associated workplace cultures. Includes case studies, guest speakers, field trips and an interdisciplinary group project culminating in the production of a computer-based portfolio for job search.

498. Computer Science Seminar (2) S

Prerequisite: 20 hours of CSC and taken in Senior Year.

The setting for administering the Major Field Test and addressing topics the department perceives the need for additional instruction. Students will synthesize previously learned concepts by developing and implementing a solution to a real-world programming problem. Each project will culminate in a report presented at a regional conference. The course may be modified at the discretion of the department.

Available in each departmental prefix:

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

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

195-6-7. Special Studies (1-4) On Demand

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

395-6-7. Special Studies (1-4) On Demand

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

495-6-7. Independent Study (1-4) On Demand

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

499. Seminar (1-3)

To be used at the discretion of the department for majors only.