

## MATHEMATICS AND COMPUTER SCIENCE

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Mathematics has been central to human achievement for over three thousand years. Important to both man's intellectual achievements and his technological advancements. Many of the theoretical studies in mathematics have evolved and have been refined over a long period of time. Many of the practical aspects of mathematics have become evident with the advancement of calculators and computers. Computer technology is assuming a major role in society. Clearly, the computer revolution has just begun. Many of the problems computer scientists and others will be expected to solve in decades to come have not yet been considered. As such, computing has evolved into a science covering the study of languages, programming, and theoretical concepts. The Department offers courses covering both the intellectual and practical sides of mathematics, the ground between, and digital computing.

A student of the Department of Mathematics and Computer Science has the opportunity of earning a Bachelor of Science degree (B.S.) in either Mathematics or Computer Science or a Master's degree in Mathematics Education. The Mathematics major also may choose to gain licensure to teach mathematics at the secondary level, or to follow a track in computer science. The computer science major may also acquire concentrations in mathematics, chemistry, physics, or business. The Department offers minors in both mathematics and computer science and also cooperates with the Education Department in offering a teaching specialty area in mathematics for Middle Grades Education majors.

The Departmental faculty welcomes the opportunity to advise the major and non-major alike. Someone thinking of majoring in mathematics and computer science is especially urged to consult with the Department Chair prior to registering for General Education courses. All majors choose advisors and are urged to consult with them periodically in order to plan and carry out their program of study.

Most non-majors fulfill the General Education requirements in mathematics by taking one of MAT 105, 107 or 108. Well-prepared students may select MAT 109 or 221 for this purpose. *Students who plan a major in mathematics should consult with the Department Chair prior to registering for General Education courses.*

### BACHELOR OF SCIENCE IN MATHEMATICS

Requirements for a Bachelor of Science Degree in Mathematics:

Sem. Hrs.

#### Major in Mathematics

Freshman Seminar	1
General Education Requirements	44
Prospective Mathematics Majors should start with MAT 109 and CSC 202 as their General Education courses in mathematics.	
MAT 107 & MAT 108 or MAT 221 may be used in place of MAT 109	
Major Requirements	
MAT 221, 222, 230, 315, 316, 325, 431, CSC 202, and 12 additional sem. hrs. of advanced mathematics (PHY 336 may count for 3 hours)	39
Electives	36

**Total: 120**

**BACHELOR OF SCIENCE IN MATHEMATICS EDUCATION (9-12)**

Coordinator: Mary Klinikowski

Upon successful completion of the program of study in Mathematics Education and related requirements, graduates are eligible for an “A” license to teach in the State of North Carolina. For a more detailed description, including the program standards and goals and objectives, turn to Undergraduate Licensure Programs in the School of Education section of this catalog.

Course Requirements	Sem. Hrs.
Freshman Seminar and General Education	45
Specialty Area	42
MAT 221, 222, 230, 315, 316, 325, 328, 411, 431, 402	
CSC 202	
6 additional hours in advanced mathematics	
Professional Studies	15
EDN 302, 308, 350, 419, SED 300	
Content Pedagogy	17
MAT 250, 400, 449	
CSC 405	
General Electives	8
<b>Total:</b>	<b>127</b>

NOTE: Students who desire teacher licensure in Mathematics Education should declare the major as soon as possible in their college career. Consultation with the Program Coordinator or program advisor prior to registering for General Education courses is strongly recommended.

**BACHELOR OF SCIENCE IN COMPUTER SCIENCE**

Requirements for a Bachelor of Science Degree in Computer Science	Sem. Hrs.
Freshman Seminar	1
General Education Requirements	44
Note: Prospective Computer Science Majors should start with MAT 109 as their first General Education mathematics course. MAT 107 and MAT 108 or MAT 221 may be used in place of MAT 109	
Major Requirements	41
CSC 155, 215, 255, 275, 325, 355, 365, 375, 395; MAT 221, 222, 315, 328	
Four courses from one of the following categories:	12-14
Category I: Computer Theory	
Both: CSC 415, 435	
two courses selected from CSC 425, 445, 465, MAT 327, PHY 356	
Category II: Computer Information Systems	
Both: CSC 385, 455;	
two courses selected from CSC 465, MGT 307, 308	
Category III: Computer Engineering	
CSC 200 or CSC 205 and one of CSC 415 or 435;	
two courses from PHY 200, 201, 356, EGR 205	
Electives	20-22
<b>Total:</b>	<b>120</b>

## ACADEMIC CONCENTRATION

### Requirements for an Academic Concentration in Mathematics Sem. Hrs.

MAT 109 (MAT 107 & MAT 108 may substitute for MAT 109)\*

MAT 221, 222, 315, 325, 328, 411, CSC 202

**Total: 27**

\*MAT 107 and 108, or MAT 109, count toward General Education

## MIDDLE GRADES (6-9) LICENSURE IN MATHEMATICS

Students majoring in Middle Grades Education (6-9) are required to complete two teaching specialty areas. For a detailed description of the program of study in Middle Grades Education, including the program standards and goals and objectives, turn to Undergraduate Licensure Programs in the School of Education section of this catalog.

Students majoring in Middle Grades Education (6-9) with a Mathematics teaching specialty area should consult with the Coordinator of Undergraduate Mathematics Education in the Department of Mathematics and Computer Science and the Middle Grades Program Coordinator in the School of Education.

### Requirements for Licensure in Mathematics for the B.S. in Middle Grades Sem. Hrs.

Education(6-9) This program was approved by the National Council for Teachers of Mathematics.

MAT 107 and 108 or MAT 109,

MAT 210\*, 215, 221, 222, 250, 315, 325, 400, 402, 411, CSC 202

**Total: 39-41**

\*If a student chooses a Mathematics Academic Concentration, then MAT 328 substitutes for MAT 210 in Middle Grades (6-9) licensure.

## MINORS

### Requirements for a Minor in Mathematics Sem. Hrs.

MAT 221, 222, 315, 316; and three additional hours selected from advanced mathematics courses (300 or above)

18

### Requirements for a Minor in Computer Science Sem. Hrs.

CSC 155, 215, 255, 275; one course from CSC 325 or 355;

and at least one additional course from CSC 201, 325, 355, 365, 375, or 385

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## COURSES

### MATHEMATICS (MAT)

#### MAT 104. Fundamentals of Mathematics

A study of topics in algebra that are essential for success in college algebra (MAT 107). Content includes solving of linear equations and inequalities as well as systems of linear equations and inequalities. Topics from geometry, polynomials, factoring, rational expressions, and radicals are also studied. (This course does not count toward earned hours or graduation requirements. Most students will be placed in this course by scores on the Mathematics Placement Test.) Fall, Spring. Credit, 3 semester hours.

#### MAT 105. Introduction to College Mathematics

Topics from mathematics including sets, logic, algebra, graphs, and functions, systems of linear equations and inequalities, geometry, probability and statistics. Applications of mathematical concepts. Problem solving is emphasized. Fall, Spring, Summer. Credit 3 semester hours. (Credit for MAT 105 will not be allowed if the student has previously received a grade of C or better in a math course with a higher catalog number unless the course is being taken to replace a grade.) PREREQ: MAT 104 or appropriate score on the Mathematics Placement Examination.

**MAT 107. College Algebra**

A study of the real numbers, algebraic expressions and sets. First and second order equations, and first order inequalities and their graphs. Functions, exponents and logarithms. Fall, Spring, Summer. Credit, 3 semester hours.

**MAT 108. Plane Trigonometry**

Angular measure, solution of right triangles, trigonometric function values of any angle, fundamental trigonometric relations, graphs of the trigonometric functions, solution of oblique triangles, and logarithmic solution of triangles. Fall, Spring, Summer. Credit, 3 sem. hours. PREREQ: MAT 107.

**MAT 109. College Algebra and Trigonometry**

Real and complex numbers, sets, inequalities, functions and their graphs; polynomials, rational functions, and algebraic functions; exponential, logarithmic, and trigonometric functions. Analytic geometry. Fall, Spring. Credit, 4 semester hours.

**MAT 118. Finite Mathematics**

Set theory, symbolic logic, permutations and combinations, probability, conditional probability, matrices and systems of equations. Some applications to stochastic processes, Markov chains, linear programming, statistics. Fall, Spring, Summer. Credit, 3 semester hours. PREREQ: MAT 107 or equivalent.

**MAT 210. Introduction to Statistics**

Elementary statistics, descriptive and inferential. Graphing data sets, finding measures of center, position, and dispersion. Probability, linear regression and correlation. Central Limit Theorem, sampling and hypothesis testing, including z-tests, student's tests, F-test, Chi-Square, and ANOVA. The use of calculators and computers is an integral part of the course. Fall, Spring. 3 semester hours. Recommended PREREQ: MAT 107 or equivalent.

**MAT 211. Survey of Geometry**

Topics covered involve: Plane and Solid Geometry, Coordinate Geometry, Transformational Geometry, Trigonometry, Logic, and Measurement Systems. These topics will emphasize fundamental concepts: points, lines, planes, angles, polygons, circle, perimeter, area, surface area, volume, and construction of figures. Various types of technology will be incorporated throughout the course. As announced. Credit, 3 semester hours. PREREQ: MAT 107 and 108 or equivalent.

**MAT 215. Calculus with Applications**

Required For: Biology Majors. Not open to Mathematics Majors. A study of functions of one variable; derivatives, integrals and their applications to Biological Sciences and Business. Special attention will be given to exponential functions with respect to growth and decay applications. Topics of multi-variant Calculus will also be included. Fall, Spring. Credit, 4 semester hours. PREREQ: MAT 107 or MAT 109 or equivalent.

**MAT 221. Calculus I**

Study of functions of one variable, topics from analytic geometry, limits and continuity; differentiation of algebraic functions; curve sketching; various applications chosen from physics, economics, and optimization. Fall, Spring, Summer. Credit, 4 semester hours. PREREQ: MAT 107 and MAT 108, or MAT 109, or equivalent.

**MAT 222. Calculus II**

A study of integrals, the definite integral, the fundamental theorem of the calculus, applications of the definite integral. The derivative and integral of exponential, logarithmic, trigonometric and inverse trigonometric functions; and techniques of integration. Fall, Spring, Summer. Credit, 4 semester hours. PREREQ: C or better in MAT 221.

**MAT 230. Introduction to Advanced Mathematics**

Introduction to set theory, elementary concepts of the topology of the real line and the plane, elementary logic, and techniques of proof. Spring. Credit, 3 sem. hours. PREREQ: MAT 221.

**MAT 250. Introduction to Teaching Mathematics in the Secondary Schools**

Designed to provide an overview of mathematics in the secondary school and early experiences for prospective mathematics teachers. These experiences include a planned program of observational and participatory experience in the mathematics classroom. Spring. Credit, 2 semester hours. PREREQ: EDN 227(302), MAT 221.

**MAT 315. Linear Algebra I**

An introduction to the theory of vector spaces, linear transformations, systems of linear equations, matrices, inverses, rank, determinants, inner products. Applications of matrices to problems involving systems of equations. Fall, Spring. Credit, 3 semester hours. PREREQ: MAT 222.

**MAT 316. Intermediate Calculus**

Selected topics from Calculus I and II from an advanced viewpoint. L'Hospital's rule, improper integrals, Taylor's theorem, infinite series. Multi-variable calculus: limits, continuity, partial derivatives, extrema, iterated integrals, and applications. Fall, Spring. Credit, 4 semester hours. PREREQ: C or better in MAT 222.

**MAT 317. Linear Algebra II**

Eigenvalues and eigenvectors, similarity of matrices, reduction of matrices to diagonal form. Cayley-Hamilton theorem, minimum polynomial, Jordan canonical form. Hermitian, unitary, and normal matrices, orthonormal basis, Gram-Schmidt process. Simplification of quadratic forms and other applications. As announced. Credit, 3 semester hours. PREREQ: MAT 315.

**MAT 322. Differential Equations**

An introduction to ordinary differential equations including classification of solutions to differential equations, existence and uniqueness of solutions, power series methods, initial value problems, and applications. Spring. Credit, 3 semester hours. PREREQ: MAT 316.

**MAT 325. Algebra I**

Introduction to groups, integral domains, rings and fields, with further study of subgroups, cyclic groups, groups of permutations, isomorphisms and homomorphisms of groups, direct products, and factor groups. Spring. Credit, 3 semester hours. PREREQ: MAT 230; PREREQ or COREQ: MAT 315.

**MAT 326. Algebra II**

Further topics in group theory; rings, integral domains, fields, ideals, quotient rings, homomorphisms, direct sums, polynomial rings, extension fields. Fall. Credit, 3 semester hours. PREREQ: MAT 325.

**MAT 327. Numerical Analysis**

An introduction to the solution of mathematical problems by computational techniques, including both finite and iterative methods and error analysis. Spring. Credit, 3 semester hours. PREREQ: MAT 315, 316, and one high level programming language.

**MAT 328. Probability and Statistics I**

Probability, sample spaces, counting techniques, random variables, discrete and continuous distribution functions, characteristics functions. Binomial, Poisson, and normal distributions. Central limit theorems. Fall. Credit, 3 semester hours. PREREQ: MAT 222.

**MAT 330. Probability and Statistics II**

Introduction to common theoretical distributions, central limit theorems, two dimensional random variables, sampling distributions, confidence intervals, hypothesis testing, regression theory and applications. Spring. Credit, 3 semester hours. PREREQ: MAT 316, 328.

**MAT 400. Methods of Teaching Mathematics in Middle Grades and Secondary Schools (EDN 400)**

Presents modern techniques, methods, materials, and assessment practices in the teaching of mathematics. Directed observation in middle or high school mathematics classes. Laboratory work provides experience in developing lesson plans that utilize materials and methods appropriate for classroom use. *NOTE: This course should precede teaching internship by no more than one academic year.* Fall. Credit, 3 semester hours. PREREQ: MAT 250.

**MAT 402. A Historical Development of Mathematics**

A study of the development of mathematics in its historical setting from its earliest beginnings to modern times. Note: This course may not be used as an Advanced Mathematics requirements for the Major in Mathematics. Spring. Credit, 3 semester hours. PREREQ: MAT 222.

**MAT 411. College Geometry**

A rigorous development of metric and synthetic approaches to Euclidean and non-Euclidean geometries using an axiomatic format. Similarities and differences among definitions, axioms, theorems, and postulates of non-Euclidean geometries will be considered. The relationship of these geometries to Euclidean geometry will also be studied. Fall. Credit, 3 semester hours. PREREQ: MAT 230; PREREQ or COREQ: MAT 315.

**MAT 415. Theory of Numbers**

An introduction to the properties of integers, prime and composite numbers, Fermat's Theorem, arithmetic functions, quadratic residues, Diophantine equations, continued fractions and congruences. As announced. Credit, 3 semester hours. PREREQ: MAT 222.

**MAT 422. Applied Mathematics**

Introduction to mathematical modeling. Techniques and properties of discrete and continuous models. Case studies. Fall. Credit, 3 semester hours. PREREQ: MAT 315 and MAT 322.

**MAT 431. Advanced Calculus I**

An introduction to modern mathematical analysis with careful attention to topics of elementary and intermediate calculus of one or more variables. Topics include convergence of sequences and series, mean value theorems, the Cauchy criterion, integrability. Fall. Credit, 3 semester hours. PREREQ: MAT 230 and 316.

**MAT 432. Advanced Calculus II**

A continuation of Advanced Calculus I including such topics as the total derivative of multi-variable functions, transformations of  $R^n$ , representations of functions by series and integrals, and uniform convergence. Spring. Credit, 3 semester hours. PREREQ: MAT 431.

**MAT 444. Complex Analysis**

Complex numbers, analytic functions, conformal mappings, contour integration, Cauchy's theorem and integral formula. Taylor and Laurent expansions, analytic continuation, and Liouville's theorem. As announced. Credit, 3 semester hours. PREREQ: MAT 316.

**MAT 449. Internship in Mathematics in the Secondary School**

Provides a semester-long full-time teaching experience in an off campus public school setting. Pass/Fail grading. Spring. Credit, 9 semester hours. PREREQ: MAT 400

**MAT 499. Independent Study**

Offered for mathematics majors on approval of the Department Chair. Credit, 1-3 semester hours.

**MATS 4xx. Special Topics (Variable Title)**

A study of special topics in mathematics or mathematics education. May be repeated to a maximum of 6 hours. As announced. Credit, 1-3 semester hours. PREREQ: Permission of instructor.

**COMPUTER SCIENCE (CSC)****CSC 100. Introduction to Computers**

The content of this course includes a discussion of computer hardware, computer software, the history of computing, and typical applications of computers. A significant amount of time is devoted to such applications as word processing, spreadsheets, data bases, and graphics. Additional topics for discussion include a brief introduction to computer languages, effects of computers on society and the individual, data communications, and artificial intelligence. Fall, Spring, Summer. Credit, 3 semester hours.

**CSC 155. Foundations of Computing**

Overview of the local computing environment. History of digital computers. Introduction to computer organization, data representation, and programming. Fall, Spring, Summer. Credit, 3 sem.hrs.

**CSC 200. Introduction to Computer Programming – FORTRAN**

A first course in programming using concepts of structural programming and algorithmic analysis with emphasis on scientific applications. Details of structured FORTRAN. As announced. Credit, 3 semester hours. PREREQ: CSC 155, MAT 107, or permission of instructor.

**CSC 201. Introduction to Computer Programming – COBOL**

A first course in programming using concepts of structured programming and algorithmic analysis with emphasis on data processing applications. Details of the COBOL language. As announced. Credit, 3 semester hours. PREREQ: CSC 155 or permission of instructor.

**CSC 202. Microcomputer Programming**

A first course in microcomputer programming emphasizing both numeric and string processing, and structured programming. (Visual BASIC and Delphi) using IBM compatible computers. Fall, Spring. Credit, 3 semester hours. PREREQ: CSC 100, or CSC 155, or permission of instructor.

**CSC 205. Introduction to Programming—C**

A first course in programming the C-Language using concepts of structured programming and algorithmic analysis with emphasis on application. As announced. Credit, 3 semester hours. PREREQ: CSC 155.

**CSC 206. Introduction to Programming—Java**

A first course in programming Java using concepts of structured programming and algorithmic analysis with emphasis on application. As announced. Credit, 3 semester hours. PREREQ: CSC 155.

**CSC 215. Discrete Structures**

Discrete structures with applications to Computer Science. Boolean algebra. Sets. Functions and relations. Propositional logic. Induction. Permutations and combinations. Finite state machines. Trees and graphs. Vectors and matrices. Fall, Spring. Credit, 3 semester hours. PREREQ: MAT 109 or equivalent.

**CSC 255. Programming and Algorithms I**

Introduction to programming. Representation of data, constants, and variables. Arithmetic and logical expressions. Simple I/O. Arrays. Subprograms. Searching, sorting, and merging. Techniques of problem solving. Stepwise refinement. Principles of documentation. Fall, Spring, Summer. Credit, 3 semester hours. PREREQ: C or better in CSC 155.

**CSC 275. Programming and Algorithms II**

Principles of good programming style. Control flow. Debugging and testing. String processing. Further methods of searching and sorting. Recursion. Stacks and linked lists. Records and built-up data types. Fall, Spring, Credit, 3 semester hours. PREREQ: MAT 109 and C or better in CSC 255.

**CSC 325. Fundamentals of Computer Systems**

Computer structure, machine language, assembly language, and addressing modes. File structures and I/O. Memory management. Assemblers, linkers, and loaders. Fall. Credit, 3 semester hours. PREREQ: CSC 215 and CSC 275. CSC 275 is a co-requisite with a B- or better in CSC 255.

**CSC 355. Data Structures**

Design of algorithms. Graphs, paths, and trees. Analysis of algorithms for internal and external sorting, searching, and merging. Hashing. Algorithms for dynamic storage allocation. Fall, Spring. Credit, 3 semester hours. PREREQ: CSC 215 and C or better in CSC 275.

**CSC 365. Introduction to Computer Architecture**

Basic logic design; sequential circuits; digital storage and access; processor study. Alternate architectures. Spring. Credit, 3 semester hours. PREREQ: CSC 325.

**CSC 375. Programming Languages**

An introduction to programming languages design and implementation. Survey of several major languages and their features. An emphasis on implementation details. Spring. Credit, 3 semester hours. PREREQ: CSC 275 and CSC 325.

**CSC 385. File Processing**

File processing environment. Sequential access. External sort and merge algorithms. Random access methods. Trees, lists, inverted lists, multilists. Indexed sequential and hierarchical structures. COBOL language. Spring. Credit, 3 semester hours. PREREQ: CSC 325, CSC 355.

**CSC 390. Networking and Communications**

An introduction to data communications and networking including multiplexing, TCP/IP, hubs, routers, gateways, network topologies. Also introductory material on the principles of data communication, computer communications architecture, transmission media, analog and digital signal representation, data transmission, error detection and correction, data compression, point-to-point protocols. Other topics as time allows: streaming media protocols, ICANN policies, DNS. As announced. Credit, 3 semester hours. PREREQ: CSC 355, CSC 365

**CSC 395. Introduction to Finite Automata**

Introduction to formal language theory, finite automata, regular expressions and regular grammars; push-down automata; context-free grammars; and context-sensitive grammars. Fall. Credit, 3 semester hours. PREREQ: CSC 325, CSC 355.

**CSC 405. Current Topics in Computers in Education**

The application of computer software in the classroom, including integration of software with lesson plans. Additional topics include matching software to the most appropriate hardware. This course is designed as a pre-service course for teachers, and may not be used as an advanced MAT or CSC requirement. It is not to be counted toward the Mathematics Concentration at the Graduate level. As announced. Credit, 3 semester hours. PREREQ: Permission of instructor.

**CSC 415. Translators and Compilers**

Interpreters, assemblers, and compilers. Grammar, languages, syntax, semantics, and BNF. Parsing and symbol tables. One and two pass assemblers. Design of interpreters and compilers. Large programming project. Spring. Credit, 4 semester hours. PREREQ: CSC 375, CSC 395.

**CSC 425. Advanced Software Project**

An assigned, individual, in-depth programming project includes design, documentation, and testing. As announced. Credit, 3 semester hours. PREREQ: CSC 325, CSC 355.

**CSC 435. Operating Systems**

I/O and interrupt structure, procedure activation. Monitors and kernels. System evaluation with elementary queuing, modeling, and statistical analysis. Memory management with paging, virtual memory, and multiprogramming. Process management, semaphores, deadlocks, and schedulers. Large programming project. Fall. Credit, 4 semester hours. PREREQ: CSC 365 and MAT 222.

**CSC 445. Design and Analysis of Algorithms**

Time and space complexity of algorithms. Survey of various design techniques such as “divide and conquer” and the “greedy” method. Program verification and validation. NP-Complete and NP-Hard problems. As announced. Credit, 3 semester hours. PREREQ: CSC 355, and MAT 222.

**CSC 455. Systems Analysis and Design Project**

Formal models of structured design and programming. Information hiding. Iterative enhancement. Structure of programming teams. Program libraries, walk-throughs and documentation. Development of a large software project by student teams. Spring. Credit, 4 semester hours. PREREQ: CSC 355.

**CSC 465. Database Management Systems**

Goals of DBMS including data independence, relationships, logical and physical organizations, schema, and subschema. Hierarchical, network and relational models. Examples of implementation. Data descriptor languages. Query facilities. File organization. Index organization. Data integrity and reliability. As announced. Credit, 3 semester hours. PREREQ: CSC 355.

**CSC 495. Seminar in Computer Science**

Advanced software topics. As announced. Credit, 3 semester hours. PREREQ: CSC 325, CSC 355, and MAT 222; permission of instructor.

**CSC 496. Seminar in Computer Science**

Advanced hardware topics. As announced. Credit, 3 semester hours. PREREQ: CSC 325, CSC 355, and MAT 222; permission of instructor.

**CSC 499. Independent Study**

Open to seniors in Computer Science with a quality point average of 3.0 in the major and with approval of the Department Chair. Required written and oral reports. As announced. Credit, 1-3 semester hours.

**GRADUATE COURSES**

See the School of Graduate Studies section of the Catalog.

