conducted in estuarine and marine environments and may require weekend commitments. Three laboratory hours per week. S, odd years.

**477 Ecology of Coral Reefs.** (3) (Prereq: permission of the instructor) Principles of organization, structure, productivity and biological diversity of coral reef ecosystem, with emphasis on their sensitivity and stability. Three lecture hours per week plus a two-week field experience on a tropical coral reef. Su.

**479 Marine Benthic Ecology.** (3) (Prereq: MSCI 302) (Coreq: MSCI 479L) This course presents a comprehensive review of the structure and function of soft bottom marine communities. Taxonomic coverage ranges from microbial members (bacteria and microphytobenthos) to megafauna and demersal fishes. Ecological predation, cryptic coloration, diversity, benthic pelagic coupling and more. Three lecture hours per week. S, even years.

**479L Marine Benthic Ecology Laboratory.** (1) (Coreq: MSCI 479) The laboratory demonstrates the topics and principles presented in lecture. The lab involves group work in the field and laboratory culminating with oral presentations at the end of the course. Three laboratory hours per week. S, even years.

**487, 488, 489 Selected Topics in Marine Science.** (1-4) (Prereq: permission of the instructor) These topics are designed to allow the development of seminars and courses in special areas of marine science. Offered as needed.

**495 Marine Environmental Issues.** (3) (Prereq: MSCI 301 or 302 or 304, or 305 or by permission of the instructor) (Coreq: MSCI 495L) Theoretical and applied approaches to present day environmental problems are presented and critically discussed. Emphasis is placed on the solutions and future impacts. Students are presented overviews of several environmental issues and will generate a comprehensive analysis of the associated technical, economic, social and political issues and proposed solutions. The class meets with several state and federal agencies involved in present day environmental issues providing students with exposure to "real world" applications. Each student will be required to give an oral presentation. Three lecture hours per week. S.

**495L Marine Environmental Issues Laboratory.** (1) (Coreq: MSCI 495) The laboratory demonstrates the topics and principles presented in lecture. Three laboratory hours per week. S.

**497 Marine Science Senior Thesis.** (3) (Prereq: Completion of the Marine Science Core or permission of the Department Chair. A contract must be approved by the instructor and the Department Chair by the time of registration.) Each student plans and executes an original research project with guidance and supervision of a Marine Science faculty member. Results are presented in written and oral form. Senior thesis is strongly suggested for students intending to pursue graduate studies. F, S, Su.

**499 Directed Undergraduate Research.** (3-6) (Prereq: A contract must be approved by the instructor and the Department Chair by the time of registration) Structured undergraduate research projects conducted with faculty direction and participation, or within the context of an approved off-campus internship. Projects explore marine or related problems using the scientific method. One conference and no less than five laboratory or field research hours per week. F, S, Su.

**MATHEMATICS (MATH)**

**130 College Algebra.** (3) (Prereq: Placement test) Properties of functions, techniques of graphing polynomial and rational functions, systems of equations, and properties and applications of exponential and logarithmic functions. F, S, Su.

131 Trigonometry. (3) (Prereq: MATH 130 or 130I or placement test) Right triangle and circular trigonometry, graphs of trigonometric and inverse trigonometric functions, trigonometric identities, solving trigonometric equations, vectors, complex numbers, and their applications. F, S, Su.

132 Calculus for Business and Social Science. (3) (Prereq: A grade of C or better in MATH 130 or 130I or placement test) Limits, derivatives of algebraic, exponential, and logarithmic functions, curve sketching, applications to optimizing, and antidifferentiation. F, S, Su.

135 Precalculus. (4) (Prereq: Math placement) Properties of functions, techniques of graphing polynomial and rational functions, systems of equations, and properties and applications of exponential and logarithmic functions. Right triangle and circular trigonometry, graphs of trigonometric and inverse trigonometric functions, trigonometric identities, solving trigonometric equations, vectors, complex numbers, and their applications. F, S.

139 Basic Concepts of Contemporary Mathematics. (4) This course is designed for students not intending to take an advanced course in mathematics. Selected topics include set theory, logic, statistics, probability, and consumer mathematics, with emphasis on critical thinking and problem solving. F, S, Su.

159 Calculus Calisthenics. (1) This course reviews the mathematics required in Calculus.

160 Calculus I. (4) (Prereq: MATH 130 or MATH 130I and a C or better in MATH 131, or a C or better in MATH 135, or placement test) Limits, continuity, differentiation and integration of algebraic and transcendental functions, applications of the derivative to curve sketching, optimization and related rates. F, S, Su.

161 Calculus II. (4) (Prereq: Grade of C or better in MATH 160). Applications of integration, techniques of integration, parametric equations, the polar coordinate system, conic sections sequences and series F, S, Su.

173 Discrete Mathematics for Middle School Teachers. (3) (Prereq: MATH 160) Develop the number systems used in mathematics, with special focus on discrete systems and fundamental ideas of number theory. Introduce the basic ideas of discrete mathematics: graphs, trees, and combinatorics. Basic probability. S.

174 Introduction to Discrete Mathematics. (3) (Prereq: MATH 130 or 130I) Set theory, logic divisibility, induction, combinatorics, relations, functions, graphs, digraphs, and Boolean algebra. F, S.

190 Freshman Seminar in Mathematics. (1) Problems from various areas of mathematics will be discussed with emphasis placed on introducing students to mathematical ideas beyond computation. Writing in mathematics will also be covered. S.

201 Mathematics for Early Childhood and Elementary Education Majors I. (3) (Prereq: Mathematics Placement Test results into MATH 130 or 130I) Set theory, the meaning of number and the structure of the real number system, algorithms, elementary number theory, and problem solving. F, S, Su.

202 Mathematics for Early Childhood and Elementary Education Majors II. (3) (Prereq: MATH 201) Informal geometry and basic concepts of algebra. Open only to students in early childhood and elementary education. F, S, Su.

205 Algebraic Thinking for Middle School Teachers. (3) (Prereq: MATH 160 with a grade of C or better) An exploration into algebraic thinking for pre-service middle school
students through connecting algebra to other areas of mathematics. Problem solving, matrix logic, recursive relationships, functions, statistics, proportional reasoning, geometry, and graphing will be examined. Graphing calculators will be used. F.

215 Introduction to Operations Research. (3) (Prereq: MATH 174 with a grade of C or better) Introductory course in deterministic operations research, elementary linear algebra, the linear programming model and graphing, simplex and software methods of solution, duality and sensitivity analysis, transportation and assignment problems. Emphasis is on modeling and problem solving. S.

219 Problem Solving Strategies for Middle School Teachers. (3) (Prereq: MATH 160 with a C or better) Methods of problem solving used for middle school students. Includes pattern recognition, diagrams, matrix logic, and the study of special cases. Major emphasis on explanation and reflection of the problem solving process. S.

220 Mathematical Proofs and Problem Solving. (3) (Writing Intensive) (Prereq: MATH 161 with a grade of C or better) Detailed investigation of the methods of mathematical proof: direct, indirect, induction, contradiction, case analysis and counter examples. Topics include set theory, functions, relations, cardinality, elements of number theory, elements of real analysis and elements of abstract algebra. Major emphasis placed on understanding, attacking and problem solving. F, S.

242 Modeling for Scientists. (3) (Writing Intensive) (Computer Usage) (Prereq: MATH 160) (Coreq: MATH 242L) The class is designed to introduce students to concepts in mathematical modeling and scientific computing. The course is project based, and Computer Software will be used extensively to implement models, solve problems, and visualize results. Topics include counting by enumeration, population dynamics, Newton’s method for finding roots of equations, and fractal generation. F, S.

242L Modeling for Scientists Laboratory. (1) (Coreq: MATH 242) Students are introduced to using a computer modeling software package. Lab assignments help students utilize software to implement models, solve problems, and visualize results. F, S.

260 Calculus III. (4) (Prereq: MATH 161 with a grade of C or better) Lines, planes and surfaces in space; spherical and cylindrical coordinate systems; vector valued functions; differentiation of functions of several variables; multiple integration and applications; topics in vector analysis. F, S.

307 Combinatorics. (3) (Prereq: MATH 220 with a C or better or MATH 174) This course covers the basics of combinatorics: enumeration, recurrence, generating functions, as well as some applications to probability. S, odd years.

308 Graph Theory. (3) (Prereq: MATH 220 with a C or better or MATH 174) This course will introduce students to the basic concepts and applications of graph theory. This will be achieved via examples, algorithms and proofs. F, odd years.

320 Elementary Differential Equations. (3) (Prereq: MATH 161 with a grade of C or better) This course represents a systematic introduction to ordinary differential equations. Topics may include first order equations, linear equations with constant coefficients, techniques for higher order equations, variation of parameter, systems of equations, and numerical solutions. F, S.

329 Introduction to Financial Mathematics. (3) (Prereq: MATH 161) Required for a minor. This course aims to introduce students to three major areas of mathematical finance that all have an enormous impact on the way modern financial markets operate. In particular, two Nobel Prize winning theories: Black-Scholes’ arbitrage pricing of options and other derivative securities, and Markowitz portfolio optimization theory and the Capital Asset Pricing Model. Time permitting students will study interest rates and their term structures. F.
330 **Geometry for Middle School.** (3) (Prereq: MATH 160) Geometry taught from varying viewpoints. Includes basic geometric topics, taxicab geometry, and proof by pictures, and compass and straightedge constructions. May include a component involving technology. Other topics which may be covered include convex sets and the geometry of transformations. F.

331 **Foundation of Geometry.** (3) (Writing Intensive) (Prereq: MATH 220 with a grade of C or better or permission of the instructor) A rigorous development of Euclidean and Non-Euclidean geometries. May additionally cover the Theory of Isometries. F.

332 **Modern Geometry.** (3) (Writing Intensive) (Prereq: MATH 220) Projective geometry, theorem of Desargues and Pappus, transformations, convexity, and topology. Offered as needed.

342 **Modeling for Scientist.** (3) (Prereq: Grade of C or better in Math 320 and Math 242) (Coreq: Math 342L) This course is a continuation of Math 242 and will continue to develop student’s ability to use mathematical modeling and scientific computing to solve real world problems. This course is project based and will extensively use computer software. F.

342L **Modeling for Scientist II.** (1) (Prereq: Grade of C or better in Math 320 and Math 242L) (Coreq: Math 342) Students continue developing their skills with a computer modeling software package. Lab assignments help students utilize software to implement models, solve problems, and visualize results. F.

344 **Linear Algebra.** (3) (Prereq: MATH 161 with a C or better) Vector spaces, linear transformations, matrices, systems of equations, determinants, eigenvectors and eigenvalues. F, S.

349 **Nonlinear Dynamics with Applications.** (3) (Prereq: STAT 201) (Coreq: MATH 161) The basics of linear and non-linear difference equations and their relationship to linear and non-linear differential equations. Stability for first order equations and an introduction to chaos theory. Phase plane analysis, cobweb diagrams, and time series analysis. Emphasis on applications to real life scientific data. Offered as needed.

370 **Elementary Number Theory.** (3) (Prereq: MATH 161 or permission of the instructor) Divisibility theory, Diophantine equations, primes, congruences, Fermat's theorem, number theoretic functions, Euler's theorem, Pythagorean triples. Offered as needed.

397 **Mathematics Practicum.** (1) (Prereq: MATH 260, GPA in mathematics courses greater than or equal to 3.0 and permission of the instructor) By working with faculty teaching introductory level college mathematics courses, students have the opportunity to enhance and/or increase their understanding of those concepts of mathematics that are the foundation of these courses. A student may not enroll in this course more than 3 times nor will the course satisfy any requirement for the major or minor in mathematics or any core requirement. Pass/Fail grading only. F, S.

399 **Independent Study/Internship.** (1-4) (Prereq: A contract must be approved by the instructor and the Department Chair by the time of registration.) Directed study of specific topics or supervised work as part of an approved internship. F, S, Su.

403 **Actuarial Science Exam Preparation.** (1) (=CBAD 403) (Coreq: STAT 412) This course serves as a testing and preparation opportunity for students planning to sit for the Society of Actuaries exam P/1. Offered as needed.

407 **Coding Theory.** (3) (Prereq: MATH 220 with a C or better or MATH 174) (=CSCI 407) This course covers the issues involved in designing efficient codes, including error detection/correction. Topics to be covered include distance, nearest neighbor decoding, hamming codes and linear codes. Other topics which may be covered are Golay codes, Reed-Muller codes, cyclic codes, and spherical codes. S, even years.
Cryptography. (3) (Prereq: MATH 220 with a C or better or MATH 174) (=CSCI 408) This course introduces students to the fundamentals of cryptography and cryptanalysis, primarily focusing on data encryption and decryption. Topics will include: modular arithmetic, classical encryption schemes, modern encryption schemes, password security, and digital signatures, secret sharing. F, even years.


Abstract Algebra. (3) (Prereq: MATH 220 and MATH 344 with a grade of C or better) Fundamental properties of groups, rings, and fields. S.

Abstract Algebra Laboratory. (1) (Coreq: Math 446) This laboratory uses GAP (Groups, Algorithms and Programming) software to explore the concepts introduced and developed in Math 446. S.

Advanced Calculus I. (3) (Prereq: MATH 220 and 260 with a grade of C or better) Sequences, series, continuity, differentiation and integration, and sequences and series of functions. F.

Complex Variables. (3) (Prereq: MATH 260 with a grade of C or better) Complex numbers and functions (trigonometric, exponential, logarithmic, hyperbolic, inverse, analytic, and harmonic), and complex limits, continuity, differentiation, integration, sequences and series. F, even years.

Analysis. (3) (Prereq: MATH 450 with a grade of C or better or permission of the instructor) Least upper bound axiom, metric spaces, continuous functions on metric spaces, completeness, compactness, existence of the Riemann integral, and the fundamental theorem of calculus. S.

Numerical Calculus. (3) (Prereq: Working knowledge of Matlab or a programming language) (Coreq: MATH 344) Introduction to numerical methods of interpolation, polynomial approximation, solving equations in one variable, solving linear systems of equations, numerical differentiation, numerical integration and error analysis. S.

Applied Mathematics I. (3) (Prereq: MATH 320 with a grade of C or better) Orthogonal sets of functions and the Sturm-Liouville eigenvalue problem; Fourier series and integrals, and solution of partial differential equations by separation of variables; boundary value problems in polar, cylindrical, and spherical coordinate systems, Bessel functions. F, odd years.

Seminar in Mathematics. (1) (Writing Intensive) (Prereq: Completion of 21 hours in mathematics in courses numbered 150 or higher) Problems from various areas of Mathematics will be discussed with emphasis placed on developing the students capability to do research of an expository nature and to present their results in both written and oral form. F.

Directed Undergraduate Research. (1-3) Topics in pure and applied Mathematics and/or selected to meet current faculty and student interest. F, S, Su.

MUSIC (MUS)
A description of Applied Music courses follows the course descriptions of all other music courses.

Recital Class. (0) Required attendance for all students enrolled in applied lessons. Attendance and participation in student performances, recitals, and seminars. Graded S or U.

Introduction to Music. (3) A course open to all students who are interested in gaining a comprehensive appreciation of music through intelligent listening. Representative