MATHEMATICS (MAT)

MAT 103 INTRODUCTION TO MATHEMATICS
3, 3/0; MQ23

Some of the greatest achievements of mathematical thought, highlighting the beauty and creativity of these ideas. Topics include Fibonacci numbers; the golden rectangle; estimation; comparing infinities; fractals; the Pythagorean Theorem; the five platonic solids; and selected topics from probability and statistics. Designed for liberal arts majors who do not plan to take further math courses. Offered every semester.

MAT 107 CASINO GAMBLING
3, 3/0

Learn how the laws of probability and mathematical expectation can uncover the player's disadvantage in various gambling situations. An essential element in the classroom will be the actual playing of the major casino games so that the student gains first-hand encounters with the phenomenon of chance and the problems of making a decision in the face of uncertainty.

MAT 114 FUNCTIONS AND MODELING
3, 3/0; MQ23

Prerequisite: 3 years high school mathematics or equivalent. Describe and explore real-world functions, data, and phenomena through graphic, numeric, symbolic, and verbal representations. Use elementary functions (linear, polynomial, power, and exponential) to investigate and analyze applied problems (supported by the use of appropriate technology). Offered every semester.

MAT 121 ELEMENTARY MATHEMATICS FROM AN ADVANCED STANDPOINT I
4, 4/0

Prerequisite: 3 years of high school math or equivalent. First course of a two-semester sequence on the fundamental concepts of elementary mathematics: positional numeration systems, number and operations, proportional reasoning, and number theory. Emphasis on problem solving, understanding the concepts and procedures of elementary mathematics, mathematical modeling, the use of manipulatives, and effective communication of mathematical ideas. Offered every semester.

MAT 122 ELEMENTARY MATHEMATICS FROM AN ADVANCED STANDPOINT II
4, 4/0; MQ23

Prerequisite: MAT 121 or equivalent. Second course of a two-semester sequence on the fundamental concepts of elementary mathematics: 2- and 3-dimensional geometry, measurement, probability, statistics, linear and non-linear functions. Emphasis on problem solving, understanding the concepts and procedures of elementary mathematics, mathematical modeling, the use of manipulatives, and effective communication of mathematical ideas. Offered every semester.

MAT 124 FUNCTIONS AND MODELING II
3, 3/0; MQ23

Prerequisite: MAT 114 with a minimum grade of C, or equivalent. A precalculus course designed for students who have completed a minimum of three years of New York State Regents high school mathematics or the equivalent. Topics include analysis of polynomial, rational, exponential, logarithmic, and trigonometric functions from graphical, symbolic, numerical, and verbal perspectives with an emphasis on modeling and applications of those functions in real-world contexts. No credit given to students who have previously completed MAT 126 or MAT 161 or equivalent. Offered every semester.

MAT 126 APPLIED CALCULUS I
4, 4/0; MQ23

Prerequisite: MAT 124 with a minimum grade of C, or four years of Regents high school mathematics. Intuitive introduction to differential and integral calculus. Analysis of functions, derivatives of algebraic, exponential, ad logarithmic functions, applications of the derivative, anti-derivatives of simple algebraic, exponential and logarithmic functions, area and the fundamental theorem of calculus. Graphical, symbolic, numerical, and verbal representations are used for all topics. Designed for students majoring in disciplines that use calculus as a tool. No credit given to students who have previously completed MAT 161 or equivalent. Offered every semester.

MAT 127 APPLIED CALCULUS II
4, 4/0

Prerequisite: MAT 126 with a minimum grade of C, or equivalent. Continuation of MAT 126. Techniques of integration; applications of integration; introduction to differential equations including separation of variables, first order linear equations, and their applications; Taylor polynomials; Newton's method; partial derivatives; and optimization of functions of two and three variables. Graphical, symbolic, numerical, and verbal representations are used for all topics. Designed for students majoring in disciplines that use calculus as a tool. No credit given to students who have previously completed MAT 162 or equivalent. Offered every semester.

MAT 161 CALCULUS I
4, 4/0; MQ23

Prerequisite: MAT 124 with a minimum grade of C. Graphic, symbolic, and numeric representation and analysis of functions; limits; continuity; derivatives and antiderivatives of algebraic, trigonometric, exponential, and logarithmic functions; applications of the derivative and antiderivative. Appropriate for math majors and students in partner disciplines requiring understanding of fundamental principles of calculus with emphasis on deductive reasoning and proof. Offered every semester.
Equivalent Course: MAT 126

MAT 162 CALCULUS II
4, 4/0

Prerequisite: MAT 161 with a minimum grade of C. Corequisite: MAT 164. A continuation of MAT 161. Area accumulation functions; definition of the definite integral; fundamental theorem of calculus; integration techniques; applications of integrals; improper integrals; sequences and series; function approximation. Graphic, symbolic, and numeric representations are used throughout the course. Appropriate for math majors and students in partner disciplines requiring understanding of fundamental principles of calculus with emphasis on deductive reasoning and proof. Offered every semester.

MAT 163 USING TECHNOLOGY TO EXPLORE CALCULUS I
1, 0/1

Exploration of Calculus I using a programmable graphing calculator. Offered every semester.

MAT 164 USING TECHNOLOGY TO EXPLORE CALCULUS II
1, 0/1

Corequisite: MAT 162 or equivalent. Exploration of Calculus II, using a computer algebra system. Offered every semester.

MAT 189 TOPIC COURSE
1-3, 0/0

Current topics in Mathematics. Offered occasionally.

MAT 202 INTRODUCTION TO LINEAR ALGEBRA
3, 3/0

Prerequisite: MAT 161 or MAT 126. Linear systems of equations, vector spaces, and linear transformations, solving linear equations, matrix algebra, determinants, eigenvalues and eigenvectors, matrices as linear transformations, basis of a vector space, orthogonality of vectors, projecting vectors into subspaces. Offered every semester.

MAT 223 ELEMENTARY AND MIDDLE SCHOOL MATHEMATICS FROM AN ADVANCED STANDPOINT
4, 4/0

Pre-requisite: MAT 121, MAT 122. Deepens and extends content introduced in MAT 121 and MAT 122 through study of analytic and synthetic geometry, transformational geometry, statistics and fundamental concepts of probability. Emphasis on mathematical reasoning and problem solving, mathematical modeling, use of appropriate tools, and effective communication of mathematical ideas prominent in upper elementary and middle school.

MAT 241 COMPUTATIONAL TOOLS FOR APPLIED MATHEMATICIANS I
3, 3/0

Prerequisite: MAT 161. Fundamental concepts of problem solving by computer as applied to mathematics. Computer organization, operations and functions, algorithm development, programming techniques. Numerical methods as used in calculus, linear algebra, geometry, etc. Uses a computer language to be applied in this and other mathematics classes. Offered fall only.

MAT 263 CALCULUS III
4, 4/0

Prerequisite: MAT 162 with a minimum grade of C, or equivalent. Corequisite: MAT 264. Multivariable spaces and functions, multivariable derivatives, multivariable integrals, and vector analysis. Offered every semester.

MAT 264 USING TECHNOLOGY TO EXPLORE CALCULUS III
1, 0/1

Prerequisite: MAT 164.Corequisite: MAT 263. Exploration of Calculus III using a Computer Algebra System. Offered every semester.

MAT 270 DISCRETE MATHEMATICS
3, 3/0

Prerequisites: 4 years of high school mathematics or equivalent. Fundamental principles used in discrete mathematics. Topics include logic, mathematical induction, sets, relations, functions, permutations, combinations, recursion, and graph theory. Offered every semester.

MAT 295 RESEARCH EXPERIENCE IN MATHEMATICS
1-3, 1/0

Scholarship or creative work conducted under the supervision of a faculty member.

MAT 300 TECHNIQUES OF PROOF
3, 3/0

Prerequisite: MAT 162 or MAT 127. A gateway to upper-division mathematics with an emphasis on mathematical structures, techniques of proof, and the effective written and oral communication of mathematical ideas. Designed to ease the transition from lower-division mathematics to more theoretical courses such as abstract algebra and real analysis. Students are required to submit written work and make oral presentations. Offered every semester.

MAT 301 INTRODUCTION TO GROUP THEORY
3, 3/0
Prerequisite: MAT 202 and MAT 300. Definition of a group; examples of groups; commutative and noncommutative groups; subgroups; cyclic groups and cyclic subgroups; permutation groups; dihedral groups; cosets and Lagrange's theorem; normal subgroups; group homomorphisms and group isomorphisms; quotient groups; and the Isomorphism Theorems. Offered spring only.

MAT 302 ABSTRACT ALGEBRA II
3, 3/0
Prerequisite: MAT 301. Quotient fields of integral domains, polynomials, rings; Euclidean domains, ideals, and factorization; finite fields, extension fields, splitting fields. Applications to geometric constructions and solvability chosen from contemporary areas of coding theory, block designs, etc. Offered occasionally.

MAT 309 COMBINATORICS
3, 3/0
Prerequisite: MAT 162 or MAT 127. Basic counting principles including permutations, combinations, the multiplication and addition rules, and the pigeonhole principle; distribution problems; combinatorial proofs; counting the complement and inclusion-exclusion arguments; breaking counting problems down into smaller subproblems; generating functions; permutation groups and Polya's enumeration theorem; combinatorial block designs. Offered occasionally.

MAT 311 INTRODUCTORY PROBABILITY AND STATISTICS
3, 3/0; MQ23
Prerequisite: Three years of Regents high school mathematics. Descriptive statistics; probability and random variables; binomial, normal, and t distributions; estimation and tests of hypotheses concerning means, proportions, and differences between means and proportions. Does not count toward the 0718, 0719, 0721 majors. Offered every semester.

MAT 315 DIFFERENTIAL EQUATIONS
3, 3/0
Prerequisites: MAT 162 or MAT 127. Preliminary ideas of order, degree, linear/nonlinear, direction fields, and solutions; formation of differential equations; first order differential equations; second order differential equations; higher order differential equations; systems of differential equations; series solutions. Offered fall only.

MAT 316 INTERMEDIATE DIFFERENTIAL EQUATIONS
3, 3/0
Prerequisite: MAT 315. Laplace transform; inverse Laplace transform and applications; partial differential equations; Fourier series; boundary value problems; transform methods application. Offered spring only.

MAT 318 MATHEMATICAL MODELING
3, 3/0
Prerequisites: MAT 162 and MAT 202. Construction, interpretation and application of mathematical models; various modeling paradigms such as deterministic, probabilistic, discrete and continuous modeling. Models which provide valuable insights into contemporary topics from different fields that may include bio-medical applications, financial mathematics, cellular automata models, mathematical methods for data collection and analysis in geology, mathematical tools for GIS, and weather prediction. Offered fall only.

MAT 319 MATHEMATICAL BIOLOGY
3, 3/0
Prerequisites: MAT 161 or instructor permission. A project-oriented, introductory mathematical modeling course with an emphasis on the construction and analysis of mathematical models of biological events and phenomena. Mathematical topics include matrix algebra, difference and differential equations. Biological topics include population dynamics, dynamics of infectious disease and models of molecular evolution. Offered spring only.

MAT 322 MODERN GEOMETRY
3, 3/0
Prerequisite: MAT 162 or MAT 127. Axiomatic systems; Euclidean geometry; constructions; transformational geometry; symmetry; computational geometry. Offered fall semester only

MAT 325 PROBABILITY AND STATISTICS
3, 3/0
Prerequisites: MAT 127 or MAT 162. Probability (graphic representations, descriptions of probabilistic events, combinatorics and combinatorial probability); discrete and continuous probability distributions; descriptive statistics; estimation and tests of hypotheses concerning means, proportions, variance and standard deviation and differences between means and proportions. Offered spring semester only.

MAT 351 ELEMENTARY THEORY OF NUMBERS
3, 3/0
Prerequisite: MAT 162 or MAT 127. Divisibility; Euclid's algorithm; numbers; prime factorization theorem; Euler's phi-function; Diophantine analysis; congruence; theorems of Fermat, Euler, and Wilson. Offered every semester.

MAT 366 COMPUTATIONAL TOOLS FOR APPLIED MATHEMATICIANS II
3, 3/0
Prerequisites: MAT 164, MAT 241, and MAT 270; or permission of instructor. Structured programming, verification of program validity, data structures, combinatorial problems, flow network, algorithms, random number generators, simulation of random and nonrandom processes. Offered spring only.

MAT 370 APPLIED NETWORKS
3, 3/0
Prerequisites: MAT 202. Introduction to network and graph theoretic concepts. Properties with application in computational mathematics, social science, decision making, and physical science. Offered occasionally.

MAT 381 PROBABILITY THEORY
3, 3/0
Prerequisites: MAT 127 or MAT 162 and MAT 270. Calculus-based introduction to the theory of probability and its applications; axioms of probability and theorems; discrete and continuous random variables; joint, marginal, and conditional distributions; independence of events; mathematical expectation; moment generating functions; and application of special probability distributions and densities. Offered every fall.

MAT 382 TOPICS IN MATHEMATICAL STATISTICS
3, 3/0

Prerequisite: MAT 381. Calculus-based introduction to the theory of statistical inference and its applications; functions of random variables; properties of estimators; sampling distributions; point and interval estimation; theory and applications of hypothesis testing. Offered every spring.

MAT 383 APPLIED STATISTICS I
3, 3/0

Prerequisites: MAT 382 or MAT 325. Categorical data analysis; simple linear regression and correlation; multiple linear regression; experimental design models (one, two or more factors); nonparametric statistics. Offered fall only.

MAT 390 INTRODUCTION TO OPERATIONS RESEARCH
3, 3/0

Prerequisites: MAT 202 and MAT 270. Optimization of real-world problems modeled by linear objective functions subject to systems of linear inequalities and solved by either the two-phase revised simplex method of by the network simplex method. Mathematics behind these methods. Applications in diverse areas such as business management, industry, economics, finance, game theory, geometry, and networks. Offered spring only.

MAT 401 INTRODUCTION TO COMPUTABILITY
3, 3/0

Prerequisites: MAT 270 and either MAT 301 or MAT 351. Introduction to topics in finite automata and Turing machines, including universal Turing machines and abstract computability. Offered occasionally.

MAT 404 APPLICATIONS OF LINEAR ALGEBRA
3, 3/0

Prerequisites: MAT 202 and MAT 263. Eigenvalue problems; diagonalizing matrices; linear programming; simplex method; applications to areas such as business, industry, economics, social sciences, and behavioral sciences. Offered spring only.

MAT 411 COMPLEX VARIABLES
3, 3/0

Prerequisite: MAT 263. Complex numbers; analytic functions; elementary functions; contour integration; integral theorems; Taylor series; Laurent series; uniform convergence; calculus of residues; mappings and applications. Offered spring only.

MAT 417 INTRODUCTION TO REAL ANALYSIS I
3, 3/0

Prerequisite: MAT 263 and MAT 300. Elementary real analysis, including properties and axioms of the real number system; relations and functions; sequences; continuity; differentiation; infinite series; power series; Riemann integral. Offered once a year.

MAT 418 INTRODUCTION TO REAL ANALYSIS II
3, 3/0

Prerequisite: MAT 417 or equivalent. Continuation of MAT 417 with topics chosen from: Riemann-Stieltjes integration; improper integrals; infinite series; series of functions; partial differentiation; Jacobians; implicit function; multiple integrals; Fubini's Theorem. Offered occasionally.

MAT 430 SET THEORY
3, 3/0

Prerequisites: MAT 300 or PHI 307 with a grade of C or better. Fundamental facts about abstract sets–relations, functions, natural numbers, order, cardinality, transfinite recursion, the axiom of choice, Zorn's lemma, ordinal numbers, and cardinal numbers–within the framework of axiomatic set theory. Axioms used to investigate infinite sets and to generalize the concepts of induction and recursion. Offered occasionally.

MAT 431 MATHEMATICAL LOGIC
3, 3/0

Prerequisites: MAT 300 or PHI 307 with a grade of C or higher. Validity, deductibility, and completeness in propositional and predicate logics; first-order formal theories and informal theories in the context of set theory. Offered occasionally.

MAT 461 NUMERICAL ANALYSIS
3, 3/0

Prerequisites: MAT 162 or MAT 127. Numerical solutions (and error analysis) to linear and nonlinear equations; interpolation; curve fitting; function approximation; numerical differentiation and integration; differential equations. Offered occasionally.

MAT 471 INTRODUCTION TO TOPOLOGY
3, 3/0

Prerequisites: MAT 270 and either MAT 301 or MAT 417. Introduction to topology: sets and functions; metric spaces; topological spaces; connectedness; compactness; separation. Offered occasionally.

MAT 481 STOCHASTIC PROCESSES
3, 3/0

Prerequisite: MAT 325 or MAT 381. Random walks, Brownian motion, Markov chains and applications, continuous-time processes including exponential distribution and Poisson processes, software applications. Offered occasionally.

MAT 484 APPLIED STATISTICS II
3, 3/0

Prerequisite: MAT 383. Logistic regression, survival analysis, time series analysis. Offered occasionally.

MAT 486 MODELS AND METHODS OF ACTUARIAL MATHEMATICS
3, 3/0

Prerequisites: MAT 202, MAT 315 and MAT 381, or instructor permission, Applications of probability theory, calculus, linear algebra, and differential equations to the development and utilization of methods and models of actuarial mathematics such as survival models, mortality models, life tables, finite probability spaces, multivariate distributions, stochastic processes, Brownian motion, stochastic integrals, Ito's lemma. Offered occasionally.

MAT 490 SEMINAR
1-3, 1/0

Prerequisite: Senior mathematics major or permission of instructor. Investigation of topics of current interest to mathematicians, such as group theory; game theory; differential geometry; measure theory; sampling theory. Emphasis on oral presentations and discussions. Offered occasionally.

MAT 491 CAPSTONE RESEARCH IN MATHEMATICS
3, 3/0; IN23, RE23
Prerequisites: MAT 301 or MAT 417 and senior status;
or permission of instructor. Independent research under
the direction of the instructor. Composition of a research
paper and presentation of results at a seminar for faculty and
students. Offered spring only.

MAT 495 SPECIAL PROJECT
1-3, 0/0
Offered occasionally.

MAT 499 INDEPENDENT STUDY
3-12, 0/0
Offered every semester.