to seniors with minimum of 3.0 cumulative and major averages and requires the approval of the Departmental Chairperson. Exceptions may be approved by the Dean.

MORGAN STATE UNIVERSITY
Department of Mathematics
MATHEMATICS MAJOR
CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

ORIE 101	1
ENGL 101	3
HEED 100	2
MATH 241	4
MATH 215	3
PHIL 109	3
	16

FRESHMAN YEAR (SECOND SEMESTER)

ENGL 102	3
HIST 101/105	3
MATH 242	4
PHYS ED	1
BIOL 101/102	4
	15

SOPHOMORE YEAR (FIRST SEMESTER)

MATH 243	4
HUMA 201	3
HIST 102/106	3
PHYS 205	5
	15

SOPHOMORE YEAR (SECOND SEMESTER)

MATH 340	3
HUMA 202	3
PHYS 206	5
MATH 312	3
	14

JUNIOR YEAR (FIRST SEMESTER)

MATH 413 **OR** 341	3
MATH ELECTIVE	3
FREE ELECTIVE	3
MATH 431	3
SOC SCI ELECTIVE	3
	15

JUNIOR YEAR (SECOND SEMESTER)

MATH 479	3
FREE ELECTIVE	3
MATH 341 **OR** 413	3
HIST 350	3
HUMANITIES ELECTIVE	3
	15

SENIOR YEAR (FIRST SEMESTER)

MATH 343	3
MATH ELECTIVE	3
FREE ELECTIVES	6
LIBERAL ARTS CORE	3
	15

SENIOR YEAR (SECOND SEMESTER)

MATH 450	3
FREE ELECTIVES	6
LIBERAL ARTS CORE	3
MATH ELECTIVE	3
	15

TOTAL CREDIT HOURS	120

Morgan
1993-95

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Note: the following pages are for

1993-95

MORGAN STATE UNIVERSITY
Department of Mathematics
MATHEMATICS MAJOR (WITH TEACHER CERTIFICATION)
CURRICULUM SEQUENCE

by

3
3
4
1
4
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15

FRESHMAN YEAR (FIRST SEMESTER)

ORIE 101	1
ENGL 101	3
MATH 241	4
BIOL 101/102	4
HEED 100	2
ELED 199	2
	16

FRESHMAN YEAR (SECOND SEMESTER)

ENGL 102	3
MATH 242	4
PHYS. ED.	1
SOC. SCI. ELECTIVE	3
ELED 202	3
COSC 111	4
	18

3
3
5
3
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14

SOPHOMORE YEAR (FIRST SEMESTER)

MATH 243	4
HUMA 201	3
HIST 101/105	3
MATH 215	3
SCED 301	3
	16

SOPHOMORE YEAR (SECOND SEMESTER)

MATH 312	3
HUMA 202	3
HIST 102/106	3
MATH 371	3
PHIL 109	3
	15

3
3
3
3
3
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15

JUNIOR YEAR (FIRST SEMESTER)

CAS REQUIREMENT	3
MATH 421	3
HUMA ELECTIVE	3
PHYS 205	5
SCED 334 OR 428	3
	17

JUNIOR YEAR (SECOND SEMESTER)

CAS REQUIREMENT	3
PHYS 206	5
MATH 340 OR 352	3
SCED 334 OR 428	3
SCED 302	3
	17

3
6
3
3
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15
120

SENIOR YEAR (FIRST SEMESTER)

MATH 331 OR 431	3
HIST 350	3
MATH 413	3
SCED 456	3
MATH 361	3
	15

SENIOR YEAR (SECOND SEMESTER)

SCED 490	12

12

129?

Note: the following pages are from a subsequent catalog 1995-97. Thus our data for the mid nineties is a composite

MATHEMATICS

Acting Chairperson of Department: ASSOCIATE PROFESSOR ARTHUR D. GRAINGER; Professor: STEPHEN GEWIRTZ; Associate Professors: Ki WOONG KIM, NATHANIEL KNOX; Assistant Professors: XIAO-XIONG GAN, JEAN-BERNARD NESTOR, AHLAM EL-HAGE TANNOURI, LEON WOODSON; Instructors: RUTH EDIDIN, CORNELIA HSU, JOYCE T. MYSTER, SHIRLEY RUSSELL; Lecturers: GLENN BOOKER, EDWARD J. DANIAL, NADEZHDA ENURAH, SAMUEL N. ENURAH, QING QING FU, SHIRLEY HOWARD, EUN HO MOON LEE, JAMES LEVEQUE, BHAMINI P. NAYAR, JAN SMID, ANDREW STILLS.

PHILOSOPHY OF THE DEPARTMENT

Mathematical methods have become indispensable to the proper functioning of our increasingly technological society. In view of this, the Department aims to assist students to develop an appreciation for the power and orderliness of logical thought, precision of expression, and the utility of mathematics. By properly selecting major and supporting courses, the student can prepare for careers in a variety of fields including research, business, government, and teaching. Recognizing the symbiosis among academic disciplines, the Department provides courses designed to meet the mathematical needs prescribed for majors in other departments.

College-wide Requirements: In addition to meeting the requirements in General Education and in the major, students must also complete six (6) credits in the Liberal Arts Core required of all majors in the College of Arts and Sciences. Options for satisfying this requirement are outlined under the section on the College of Arts and Sciences. Also, in order to qualify for graduation, students must pass the Senior Departmental Comprehensive Examination; must have taken all of their junior- and senior-level requirements in the major at Morgan (unless granted prior written permission by the Dean to take courses elsewhere); and must have earned a cumulative average of 2.0 or better and a major average of 2.0 or better, with no outstanding grades below "C" in the major (which includes all courses required for the major and required supporting courses).

THE MAJOR IN MATHEMATICS

REQUIREMENTS: Entering students should select a mathematics course in consultation with an adviser. Qualified students intending to major in mathematics are generally advised to begin with MATH 215 and MATH 241. Some less prepared students will begin with MATH 141, followed by MATH 215 and MATH 241. All required courses must be completed with a final grade of "C" or better.

Students majoring in Mathematics must take: MATH 215, MATH 241, MATH 242, MATH 243, MATH 312, MATH 340, MATH 341, MATH 343, MATH 413, MATH 431, MATH 450 or MATH 451 or MATH 452, MATH 479; PHYS 206, ELECTIVES: 9 credits in Mathematics (MATH) Numbered above 300.

MATHEMATICS MINOR

REQUIREMENTS: MATH 215, 241, 242, 243, 312 and any other MATHEMATICS course numbered above 300.

Mathematics major with teacher certification: Students should contact the School of Education and Urban Studies for specific requirements.

HONORS PROGRAM

After a student has completed MATH 215 and MATH 242, he/she may be invited by the Department of Mathematics to study for honors. In order to be eligible for participation in this program, a student's scholastic standing in terms of grade or honor points shall not be less than 3.0 in general average and not less than 3.0 in all mathematics courses completed. The following mathematics courses on the upper level must be completed with a "B" or better: MATH 312; 341; 342; 343; 413; 451 OR 452; 479. It is recommended that both MATH 451 and MATH 452 be completed.

MATHEMATICS HONOR SOCIETY

Pi Mu Epsilon is the mathematics honor society. To be eligible, one must be a junior having a 3.00 GPA overall with a 3.00 GPA in mathematics or a sophomore who has maintained at least a 4.00 GPA in at least fifteen (15) hours of mathematics courses, as well as having an overall GPA of at least 3.00. MATH 215 is the lowest numbered course which may be used in the GPA computation.

A SUGGESTED COURSE SEQUENCE FOR MATHEMATICS MAJORS

1. Advisors will help you select courses for your first year. They will use the record of courses taken previously, test scores, and your expressed interests.
2. The outline is a guide, not a rigid pattern.
3. As you become better informed of the opportunities that exist for graduate study and/or employment after graduation, consult advisors on how adaptations might be made in your plan of studies.

MATHEMATICS COURSE OFFERINGS

MATH 010, 020, 030, 040 COOPERATIVE WORK PROGRAM—*0 credit.*

MATH 106 FUNDAMENTALS OF MATHEMATICS—*Three hours; 3 credits.* This is a beginning algebra course. Topics include numbers, expressions, polynomials, exponents, radicals, linear equations and quadratic equations. High school deficiencies may be removed by passing MATH 106. This course does not count towards graduation.

MATH 109 MATHEMATICS FOR THE LIBERAL ARTS—*Four hours; 4 credits.* This is a course designed to help students develop an understanding of the

role of mathematics in modern society. It also provides practice in the application of elementary mathematical skills and concepts to real-life problems. Topics to be discussed include sets, logic, numbers, algebra, geometry, statistics, and consumer mathematics. Optional topics are probability and computers.

MATH 111 COLLEGE ALGEBRA—*Three hours; 3 credits*. This course is designed to cover the following topics: algebraic properties of the real numbers, equations and inequalities, functions, relations and graphs, systems of equations, matrices and determinants, sequences and series and other topics as time permits. Students who have previously received credit for MATH 113 may not receive credit for this course.

MATH 113 INTRODUCTION TO MATHEMATICAL ANALYSIS I—*Four hours; 4 credits*. This is the first half of a unified course in algebra, trigonometry, and analytic geometry. Students may not receive credit for both MATH 121 and MATH 113.

MATH 114 INTRODUCTION TO MATHEMATICAL ANALYSIS II—*Four hours; 4 credits*. This course is a continuation of MATH 113. Prerequisite: MATH 113 with "C" or better. Students may not receive credit for both MATH 126 and MATH 114.

MATH 117 MATHEMATICS FOR ELEMENTARY SCHOOL TEACHERS—*Three hours; 3 credits*. This course is designed specifically for elementary education majors. Prospective elementary school teachers are encouraged to enroll in this course immediately following successful completion of MATH 109. Topics to be discussed include systems of numeration, mathematical systems, topics in geometry, the real number system, statistics, and computers and calculators. Prerequisite: MATH 109.

MATH 118 FINITE MATHEMATICS—*Three hours; 3 credits*. This course covers statement calculus, set operations, counting principles, inequalities, and linear programming with applications involving optimization utilizing the simplex method. Prerequisite: MATH 111 or MATH 113.

MATH 121 PLANE TRIGONOMETRY—*Three hours; 3 credits*. This course is designed to cover the following topics: definitions and relations of trigonometric functions, solutions of triangles and applications, trigonometric identities and equations, logarithms, inverse trigonometric functions, polar coordinates and complex numbers. Prerequisite: MATH 111 with a grade of "C" or better, or instructor's permission. Students may not receive credit for both MATH 113 and MATH 121.

MATH 125 PLANE GEOMETRY FOR TEACHERS— *Three hours; 3 credits*. This course is designed specifically for pre-service and in-service high school mathematics teachers. Its purpose is to discuss elementary geometry from an advanced standpoint, that is, to provide valid definitions and proofs for concepts and theorems which may already be known. Thus, this course elucidates both elementary geometry and its history. Topics to be discussed include incidence geometry, distance and congruence, inequalities, similarity, areas and volumes, parallel and perpendicular lines, circles and spheres, and non-Euclidean geometries.

MATH 126 ANALYTIC GEOMETRY—*Four hours; 3 credits*. This course is designed to cover the following topics: two- and three-dimensional rectangular coordinate systems, lines and conic sections, translations and rotation of axes, parametric equations of loci, surfaces and solids in 3-dimensions. Prerequisite: MATH 121 or instructor's permission with the grade of "C" or better. Students may not receive credit for both MATH 114 and MATH 126.

MATH 141 PRECALCULUS—*Four hours; 4 credits*. This course reviews algebra, trigonometry, and analytic geometry; equations and inequalities; sequences and series; functions and relations including algebraic, logarithmic, exponential, and trigonometric functions; Analytic geometry including conic sections and parametric equations. Prerequisite: Departmental Permission.

MATH 200 ENHANCED SKILLS TRAINING IN MATHEMATICS—*Three hours; 3 credits*. This course will examine, analyze and explore the fundamental principles of mathematics, specifically arithmetic and elementary algebra, as it relates to the overall enhancement and development of ROTC Cadets. Special emphasis will be given to those skills needed by and required of army officers. ***Credits earned in this course do not count toward graduation.***

MATH 201 CALCULUS FOR NON-SCIENCE MAJORS—*Three hours; 3 credits*. This course covers basic concepts of calculus including functions, limits, continuity, the techniques of differentiation with applications to the managerial, life, and social sciences. It also includes an introduction to the techniques of integration with applications. A brief introduction to multi-variable calculus is also given. Prerequisite: MATH 111 or MATH 113.

MATH 215 FOUNDATIONS FOR ADVANCED MATHEMATICS—*Three hours; 3 credits*. This course covers basic logic, axiomatic treatment of sets, construction of the real number system from the Zermelo-Frankel axioms of set theory. Prerequisite: Departmental Permission.

MATH 216 DISCRETE STRUCTURES—*Three hours; 3 credits*. Topics to be discussed include graph theory, techniques of proving algorithm and program correctness, formal languages, formal machines, complexity of algorithms, coding theory, Boolean algebra and logic networks. Prerequisite: MATH 215 with grade of "C" or better.

MATH 241 CALCULUS I—*Four hours; 4 credits*. Topics to be discussed include limits and continuities of real functions of one real variable, differentiation and anti-differentiation of algebraic functions, exponential functions and logarithmic functions, chain rule, Rolle's Theorem and mean value theorem, simple applications of derivatives to various problems including max-min problems and graphing techniques. Prerequisite: MATH 114 or MATH 141 with grade of "C" or better, or Departmental Permission.

MATH 242 CALCULUS II—*Four hours; 4 credits*. This course is the continuation of MATH 241 and is designed to cover the following topics: definite integrals and their applications, fundamental theorem of calculus, techniques of integration, derivatives and anti-de-

rivatives of trigonometric functions. Integrals yielding inverse trigonometric functions, Simpson's Rule, Trapezoidal Rule, L' Hospital's Rule, sequence and series, and other topics are also considered. Prerequisite: MATH 241 with the grade of "C" or better.

MATH 243 CALCULUS III—*Four hours; 4 credits.* Topics to be discussed include partial differentiation, directional derivatives, gradients and line integrals, multiple integrals, and applications. Prerequisite: MATH 242 with the grade of "C" or better.

MATH 300 INDEPENDENT STUDY IN MATHEMATICS I—*Three hours; 3 credits.* Under this heading, a student may agree to a course with a particular faculty member on a topic not covered in the regular curriculum. The arrangements must be made with the faculty member and approved by the department chair before the student registers for the course.

MATH 312 LINEAR ALGEBRA I—*Three hours; 3 credits.* This course is designed to cover the following topics: A study of linear transformations and matrices, vector spaces, eigenvalues and canonical forms, and other topics as time permits. Prerequisite: MATH 241.

MATH 313 LINEAR ALGEBRA II—*Three hours; 3 credits.* This is a follow-up course to MATH 312. Special topics, applied and abstract, are studied. These topics include Hermitian Matrices, Quadratic Forms, Positive Definite Matrices, Canonical Forms, and other applications as time permits. Prerequisite: MATH 312.

MATH 322 SOLID ANALYTIC GEOMETRY—*Three hours; 3 credits.* This course is designed to use matrix theory and vector algebra to discuss the following topics: lines, planes and transformation of coordinates in space; quadric surfaces, the general equation of the second degree, and properties of quadrics. Prerequisite: MATH 242 with the grade of "C" or better.

MATH 331 APPLIED PROBABILITY AND STATISTICS—*Three hours; 3 credits.* This course is designed for students with one year of differential and integral calculus who wish to study the theory of probability with applications relevant to science and engineering. Topics include the following: combinatorial analysis, foundations of probability, random variables and their distributions, and applications. Prerequisite: MATH 242.

MATH 340 INTRODUCTION TO DIFFERENTIAL EQUATIONS—*Three hours; 3 credits.* This is a first course dealing with methods of solving ordinary differential equations (ODE) with application to geometry and physics. The following topics are included: first order differential equations, second or higher order linear ordinary differential equations (homogeneous and non-homogeneous), Laplace Transforms, and systems of linear ordinary differential equations. Prerequisite: MATH 242 (Calculus II).

MATH 341 ADVANCED CALCULUS I—*Three hours; 3 credits.* This course is designed to cover the following topics: topology of the real line, theory of limits, theory of differentiation and integration of functions of one variable, infinite series. Prerequisite: MATH 243.

MATH 342 ADVANCED CALCULUS II—*Three hours; 3 credits.* This course is a continuation of MATH 341. The following topics will be covered: sequences of functions, improper integrals, functions of several variables. Prerequisite: MATH 341.

MATH 343 COMPLEX VARIABLES—*Three hours; 3 credits.* This course is designed as a study of elementary functions of a complex variable, Cauchy's integral theorem and formula, residues and poles, power series, and introduction to the solutions of differential equations by series. Prerequisite: MATH 341 with grade of "C" or better.

MATH 352 NUMERICAL ANALYSIS—*Three hours; 3 credits.* This course is designed to cover the following topics: methods of deriving numerical results for mathematical procedures with attention given to the precision of the results. Computer programming techniques will also be included. Prerequisite: MATH 242 with grade of "C" or better. SPRING.

MATH 361 INTRODUCTION TO MATHEMATICAL MODELING—*Three hours; 3 credits.* An introduction to the basic principles of formulation, analysis, and simulation of mathematical models. Deterministic, dynamic, and stochastic models will be discussed. Prerequisite: MATH 242.

MATH 371 HISTORY OF MATHEMATICS—*Three hours; 3 credits.* Topics include the origins of the concepts of numbers, algebra, geometry, applied arithmetic. The contributions of famous 19th and 20th century mathematicians will also be discussed. Prerequisite: Departmental Permission.

MATH 390 SPECIAL TOPICS IN MATHEMATICS I—*Three hours; 3 credits.* Under this heading, courses on topics and applications not covered in the regular curriculum or that span several areas of mathematics will be offered.

MATH 400 INDEPENDENT STUDY IN MATHEMATICS II—*Three hours; 3 credits.* Under this heading, a student may agree to a course with a particular faculty member on a topic not covered in the regular curriculum. The arrangements must be made with the faculty member and approved by the department chair before the student registers for the course.

MATH 413 ALGEBRAIC STRUCTURES I—*Three hours; 3 credits.* This course is designed to cover the following topics: elementary theory of groups, rings, integral domains, fields and ideals. An introduction to polynomials and matrices over a field will be considered. Prerequisite: MATH 215 or MATH 312, or Permission of the Department.

MATH 414 ALGEBRAIC STRUCTURES II—*Three hours; 3 credits.* This course is a continuation of MATH 413. Topics are drawn from Galois theory, Sylow theory, finite abelian groups, and applications. Prerequisite: MATH 413.

MATH 417 AUTOMATA, COMPUTABILITY, AND FORMAL LANGUAGES—*Three hours; 3 credits.* This course discusses formal languages and the formal machines which recognize them. Prerequisite: MATH 215.

MATH 419 COMBINATORICS AND GRAPH THEORY—*Three hours; 3 credits.* This course covers general enumeration methods, difference equations, and

generating functions. Elements of graph theory including transport networks, matching theory, and graph algorithms are covered as well. Prerequisite: MATH 215.

MATH 421 HIGHER GEOMETRY—*Three hours; 3 credits*. This course introduces the student to projective, advanced Euclidean and non-Euclidean geometries and is designed to cover the following topics: transformation theory, projective theory of conics, Desargues' Theorem, duality, and projective, parabolic, hyperbolic, and elliptic geometries. Prerequisite: MATH 242 with a grade of "C" or better, or by permission of the instructor.

MATH 425 INTRODUCTION TO NUMBER THEORY—*Three hours; 3 credits*. This course covers divisibility and primes, congruences, guadratic reciprocity, arithmetic functions, and arithmetic in quadratic fields. Prerequisite: MATH 242.

MATH 431 MATHEMATICAL THEORY OF STATISTICS I—*Three hours; 3 credits*. This course is designed to cover the following: an introduction to the probability theory necessary to serve as a basis for the study of statistics, graphical representation of frequency distributions, various probability functions, various probability densities, mathematical expectation including moments and various moment generating functions. Prerequisite: MATH 242 with a grade of "C" or better.

MATH 432 MATHEMATICAL THEORY OF STATISTICS II—*Three hours; 3 credits*. This course is a continuation of MATH 431. It is designed to cover the following topics: sums of random variables, the normal distribution, student's distribution, the F-distribution and the Chi-Square distribution, principles of testing hypotheses and estimation, linear and multiple correlation and regression, analysis of variance and other topics as time permits. Prerequisite: MATH 431 with grade of "C" or better.

NOTE: The two courses in Mathematical Theory of Statistics are not a duplication of Psychology 316-317 or Economics 311-312, since MATH 431-432 emphasize the mathematical theory of statistics and require a knowledge of calculus as a prerequisite.

MATH 435 DESIGN AND ANALYSIS OF EXPERIMENTS—*Three hours; 3 credits*. This course covers principles of experimental design, and other topics chosen from completely randomized designs, block designs, Latin-square and factorial experiments, response surface exploration, and others as time permits. Prerequisite: MATH 432.

MATH 436 QUALITY CONTROL—*Four hours; 4 credits*. This course covers topics from the following: lot acceptance, sampling by attribute and by variables, theory of control charts, sequential sampling plans, and life testing and reliability. Prerequisite: MATH 432.

MATH 440 INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS—*Three hours; 3 credits*. This course covers quasilinear and nonlinear first order equations, calculus of self-adjoint operators, Strum-Lioville problems and eigenfunction expansions, fundamental solutions and Green's functions, distributions, boundary and initial value problem for potential, wave and heat equations, integral transforms, and asymptotic expansions. Prerequisites: MATH 243, MATH 312, and MATH 340.

MATH 450 SENIOR SEMINAR—*Three hours; 3 credits*. Under the direction of a faculty member, the student must write an acceptable mathematics paper. In addition, an oral presentation based on the paper must be made to a departmental audience. Prerequisite: Departmental Permission.

MATH 451 CONFERENCE COURSE—*Three hours; 3 credits*. This course is designed for seniors in the Honors Program and others admitted by the chairperson and is devoted to one or more topics in advanced mathematics. Much of the work is done through independent study with timely conferences with the instructor.

MATH 452 CONFERENCE COURSE—*Three hours; 3 credits*. This course is the same type as MATH 451 and operates independently of MATH 451.

MATH 461 OPERATIONS RESEARCH I—*Three hours; 3 credits*. This course covers linear programming including the simplex method, transportation, analysis, and a brief introduction to dynamic programming. Prerequisites: MATH 312 and MATH 331 or MATH 431.

MATH 462 OPERATIONS RESEARCH II—*Three hours; 3 credits*. This course covers integer programming, game theory, dynamic programming and an introduction to nonlinear programming. Prerequisite: MATH 461.

MATH 479 POINT SET TOPOLOGY—*Three hours; 3 credits*. This course is designed to cover the following topics: point set theory of the line and plane, topological spaces and properties and mappings. Prerequisite: MATH 341 with a grade of "C" or better.

MATH 490 SPECIAL TOPICS IN MATHEMATICS II—*Three hours; 3 credits*. Under this heading, courses and topics and applications not covered in the regular curriculum or that span several areas of mathematics will be offered.

MATH 498 SENIOR INTERNSHIP—*Five hours; 3 credits*. This course provides the opportunity for the student to obtain supervised work experience in the major at an off-campus site selected and approved by the Departmental Chairperson. Registration is limited to seniors with minimum 3.0 cumulative and major averages and requires approval of the Departmental Chairperson. Exceptions may be approved by the Dean.

MATH 499 SENIOR RESEARCH OR TEACHING/TUTORIAL ASSISTANTSHIP—*Five hours; 3 credits*. This course provides the opportunity for the student to attain first-hand research or teaching/tutorial experience under the supervision and mentorship of a tenure-track faculty member. Registration is limited to seniors with minimum of 3.0 cumulative and major averages and requires the approval of the Departmental Chairperson. Exceptions may be approved by the Dean.