Department of Mathematics
The Ohio State University

1997-1998 Mathematics Courses

Course Number	Course Title
50	Pre-College Mathematics I
75	Pre-College Mathematics II
76	Reentry Precollege Math
104	Basic College Mathematics
105	Mathematics for Elementary Teachers I
106	Mathematics for Elementary Teachers II
107	Topics in Mathematics for Elementary Teachers
116	Survey of Finite Mathematics
117	Survey of Calculus
130	Math Analysis for Business I
131	Mathematical Analysis for Business II
132	Mathematical Analysis for Business III
148	College Algebra
150	Elementary Functions
151	Calculus and Analytic Geometry
152	Calculus and Analytic Geometry
153	Calculus and Analytic Geometry
254	Calculus and Analytic Geometry
151C	Calculus and Analytic Geometry
152C	Calculus and Analytic Geometry
153C	Calculus and Analytic Geometry
254C	Calculus and Analytic Geometry
161	Accelerated Calculus with Analytic Geometry
162	Accelerated Calculus with Analytic Geometry
263	Accelerated Calculus with Analytic Geometry
161H	Accelerated Calculus with Analytic Geometry
162H	Accelerated Calculus with Analytic Geometry
263H	Accelerated Calculus with Analytic Geometry
190H	Elementary Analysis I
191H	Elementary Analysis II
264H	Elementary Analysis III
140	Special Calculus Options 1997-1998
141	Special Calculus Options 1997-1998

Course Number	Course Title
194A	Group Studies in Mathematics
255	Differential Equations and Their Applications
345	Foundations of Higher Mathematics
366	Discrete Mathematical Structures I
415	Ordinary and Partial Differential Equations
416	Vector Analysis and Complex Variables
487H	Advanced Problem Solving
187H	Advanced Problem Solving
504	History of Mathematics
507	Advanced Geometry
510.01	Topics in Mathematics for Elementary School Teachers
510.02	Topics in Mathematics for Elementary School Teachers
510.03	Topics in Mathematics for Elementary School Teachers
512	Partial Differential Equations and Boundary Value Problems
513	Vector Analysis for Engineers
514	Complex Variables for Engineers
520H	Linear Algebra Differential Equations Complex Analysis
521H	Linear Algebra Differential Equations Complex Analysis
522H	Linear Algebra Differential Equations Complex Analysis
530	Probability
540H	Geometry and Calculus in Euclidean Spaces and on Manifolds I
541H	Geometry and Calculus in Euclidean Spaces and on Manifolds II
547	Introductory Analysis I
548	Introductory Analysis II
549	Introductory Analysis III
551	Vector Analysis
552	Introduction to the Theory of Functions of a Complex Variable
556	Differential Equations I
557	Differential Equations II
560	Point-Set Topology
566	Discrete Mathematical Structures II
568	Introductory Linear Algebra I
569	Introductory Linear Algebra II
571	Linear Algebra for Applications I
572	Linear Algebra for Applications II
573	Elementary Number Theory
574	Geometry
575	Combinatorial Mathematics & Graph Theory
578	Discrete Mathematical Models
580	Algebra I

Course Number	Course Title
581	Algebra II
582	Algebra III
590H	Algebraic Structures I
591H	Algebraic Structures II
592H	Algebraic Structures III
616	Numerical Methods in Actuarial Mathematics
618	Theory of Interest
630	Mathematics of Life Contingencies I
631	Mathematics of Life Contingencies II
632	Mathematics of Life Contingencies III
650	Principles of Mathematical Analysis
651	Introduction to Real Analysis I
652	Introduction to Real Analysis II
653	Introduction to Real Analysis III
655	Elementary Topology I
656	Elementary Topology II
657	Elementary Topology III
670	Algebra I
671	Algebra II
672	Algebra III
694	Group Studies: Differential Equations for Engineering Applications

Mathematics 050 **5 cr.** **Precollege Mathematics I**
A, W, Sp, Su

Prerequisite:

Course Code T on Math Placement Test.

Catalog Description:

Arithmetic of fractions and decimals, basic algebra, graphing equations, geometry, exponents, applications of exponents, lines and slopes, area.

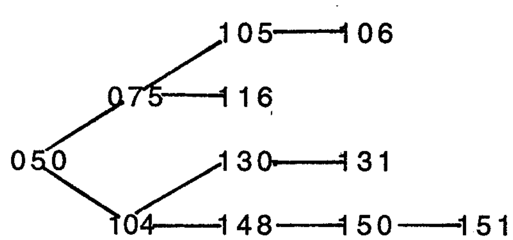
Purpose of Course:

Mathematics 050 is designed to meet the needs of the students entering The Ohio State University at the lowest placement, course code T. This course will prepare students for 075 or 104. Math conditions are removed by completion of 050, 075 or 050, 104.

Follow-up Course:

Math 075 or Math 104

Sequencing Chart:



Text:

Beginning Algebra by K. Elayn Martin-Gay, 2nd ed.

(Over for Topics and Sample Syllabus)

Topics List & Sample Syllabus

Sections	Topics
1.1-1.7	Review of Real Numbers
	Symbols and Sets of Numbers
	Fractions
	Exponents and Order of Operations
	Introduction to Variable Expressions and Equations
	Adding Real Numbers; Subtracting Real Numbers
	Multiplying and Dividing Real Numbers
2.1-2.9	Equations, Inequalities, and Problem Solving
	Simplifying Algebraic Expressions
	The Addition and Multiplication Property of Equality
	Solving Linear Equations
	An Introduction to Problem Solving
	Formulas, Percent and Problem Solving
	Further Problem Solving
	Solving Linear Inequalities
	Review and 1st Midterm
1.9, 3.1-3.4	Graphing
	Reading Graphs
	The Rectangular Coordinate System
	Graphing Linear equations
	Intercepts; Slope; Graphing Linear Inequalities
4.1-4.6	Exponents and Polynomials
	Exponents
	Addition and Subtraction of Polynomials
	Multiplication of Polynomials, Special Products
	Review and 2nd Midterm
	Negative Exponents and Scientific Notation
	Division of Polynomials
5.1-5.7	Factoring Polynomials
	The Greatest Common Factor and Factoring by Grouping
	Factoring Trinomials
	Factoring Binomials
	Choosing a Factoring Strategy
	Review and 3rd Midterm
	Solving Quadratic Equations by Factoring
	Quadratic Equations and Problem Solving
	Review and Final Exam

For Further Information See:
Lee McEwan
Sia Wong
1997-98

Mathematics 075 **4 cr.** **Precollege Mathematics II**
A, W, Sp, Su

Prerequisite:

Mathematics 050, or Course Code S or R on Math Placement Test.

Catalog Description:

Systems of equations, arithmetic of polynomials, factoring, fractional equations, variation, quadratic equations, functions, graphs, right angle trigonometry.

Purpose of Course:

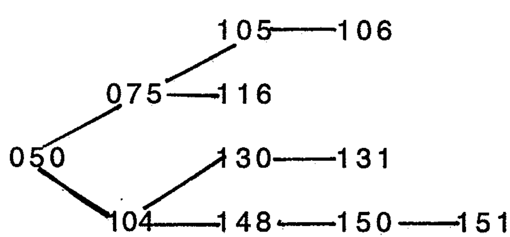
To meet the needs of students entering the University with Course Code S on Math Placement Test, or with credit for 050. In addition, **students placing at Course Code R** and who need Math 130, must take **104** prior to enrolling in 130. Completion of Math 075 is required for entry into numerous degree granting colleges; however, credit for 075 will not count toward graduation in any degree granting program. It is designed for students continuing in Math 105 or 116.

Follow-up Courses:

Math 104 for students switching to science, computer science, business or engineering curriculum.

Math 116 for students in liberal arts or students in the precertification programs on regional campuses.

Sequencing Chart:



Text:

For AU 97:

Elementary Algebra - Concepts and Applications, (4th edition), Bittinger, Keedy & Ellenbogen
Chapters 6,7,8,9 and most of 10.

(This text has been used since Winter 1995.)

For WI 98:

Beginning Algebra, (2nd ed.) Martin-Gay

(Over for Topics & Sample Syllabus)

Topics List & Sample Syllabus

Sections	Topics
6.1-6.9	Rational Expressions and Equations
	Rational Expressions
	Multiplication and Division
	Addition and Subtraction
	Least Common Multiples and Denominators
	Addition and Subtraction with Unlike Denominators
	Complex Rational Expressions
	Solving Rational Equations
	Problem Solving: Rational Equations and Proportions
	Review and 1st Midterm
7.1-7.5	Graphs and Slope
	Slope
	Slope-Intercept Form
	Point-Slope Form
	Linear Inequalities in Two Variables
	Direct and Inverse Variation
8.1-8.5	Systems of Equations and Problem Solving
	Systems of Equations and Graphing
	Systems of Equations and Substitution
	Systems of Equations and Elimination
	More Problem Solving with Systems
	Systems of Linear Inequalities
	Review and 2nd Midterm
9.1-9.7	Radical Expressions and Equations
	Introduction to Square Roots and Radical Expressions
	Multiplying and Simplifying Radical Expressions
	Quotients Involving Square Roots
	More Operations with Radicals
	Radical Equations
	Right Triangles and problem Solving
	Higher Roots and Rational Exponents
10.1-10.3	Quadratic Equations
	Solving Quadratic Equations: The Principle of Square Roots
	Solving Quadratic Equations: Completing the Square
	The Quadratic Formula and Problem Solving
	Review and 3rd Midterm
10.5	Graphs of Quadratic Equations
	Review and Final Exam

(Over for Syllabus beginning Wi 98)

Topics List & Sample Syllabus

Sections	Topics
5.5	Factoring strategies for polynomials
6.1–6.8	Rational expressions Simplifying rational expressions Multiplying and dividing rational expressions Adding and subtracting rational expressions Least common denominator Simplifying complex fractions Solving rational equations Ratio and proportion Rational equations and problem solving
	Review and first midterm
3.4, 7.1, 7.2	Linear equations Slope Slope-intercept form Point-slope form
8.1–8.4	Systems of linear equations Solving systems of linear equations by graphing Solving systems of linear equations by substitution Solving systems of linear equations by elimination Systems of linear equations and problem solving Systems of linear inequalities
3.5, 8.5	Linear inequalities Graphing linear inequalities Systems of linear inequalities
	Review and second midterm
9.1–9.7	Roots and radicals Introduction to radicals Simplifying radicals Adding and subtracting radicals Multiplying and dividing radicals Solving equations containing radicals Radical equations and problem solving Rational exponents
10.1–10.4	Quadratic equations Solving quadratic equations by the square root method Solving quadratic equations by completing the square Solving quadratic equations by the quadratic formula
	Review and third midterm
10.5	Complex solutions of quadratic equations
	Review and final exam

For Further Information See:
Brian McEnnis
Sia Wong
1997-98

INNOVATIVE STUDIES 1997-1998

1) Math 050A, 075A

050P - Au 95, 075P - Wi 96

Purpose: This two quarter project is a collaborative effort by the Mathematics Department and Mathematics Education intended for students who desire a different teaching and assessment style than the regular 050, 075 sequence. As stated by Dr. Patricia Brosnan, the goals for all students are that a) students learn to value mathematics, b) students become confident in their own ability to do mathematics, c) students become mathematical problem solvers, d) students learn to communicate mathematically, and e) students learn to reason mathematically. To implement the new teaching style, the class will be reduced to 24 students meeting MWF for 80 minute sessions as opposed to the traditional 30 students meeting MTWRF for 48 minute sessions.

Prerequisite: Placement level T, and successful completion of 050A to continue on to 075A

Text: Class Packet designed by Dr. Patricia Brosnan in the College of Mathematics Education.

Topics: Students will be exposed to the same topics as in the regular 050, 075 sequence with the use of a Class Packet designed to target problem solving, reasoning skills, communication skills, and the development of mathematical connections.

For Further Information See:
Mathematics Counseling Office
1997-98

Mathematics 076 **4 cr.** **Reentry Precollege Math**
A, W, Sp, Su

Prerequisite:

At least one year of high school algebra, out of high school for 5 or more years at time of university enrollment, no formal training in Math in the past 5 years, and written permission of the Department of Mathematics.

Catalog Description:

Arithmetic of signed numbers, exponents, linear equations, systems of equations, arithmetic of polynomials, factoring, fractional equations, variation, quadratic equation, functions, graphs.

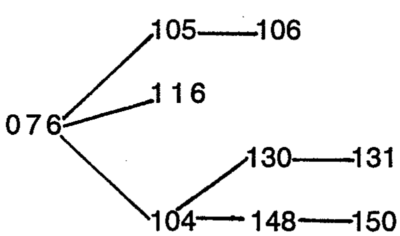
Purpose of Course:

This course is designed to meet the needs of returning, non-traditional students. It can be considered a substitute for 050 and 075 and satisfies the prerequisites for Math 104, 105, 116, or 130. Completion of Math 076 is sufficient for entry into numerous degree granting colleges; however, credit for 076 will not count toward graduation in any degree granting program.

Follow-up Courses:

- Math 104 for students in science, computer science, business, or engineering.
- Math 105 for students in some education and human ecology programs.
- Math 116 for students in liberal arts.

Sequencing Chart:



Text:

<u>Algebra, An Approach for Success,</u> Damarin and Leitzel, (Burgess International Group, Inc.)
Chapters 1 - 6, 8 - 11

(Over for Topics)

Topics List

1. Arithmetic of signed numbers

2. Exponents
   integral exponents and rational exponents (numerically)
   laws of exponents
   simplification of exponential expressions

3. Word problems

4. Solving linear equations and inequalities

5. Graphs of equation

6. Linear equations
   standard form; slope - intercept form

7. Parallel and perpendicular lines

8. Systems of linear equations

9. Polynomials
   addition, subtraction, multiplication
   division with quotient and remainder

10. Factoring polynomials
    common monomial factor
    quadratics
    by grouping

11. Rational roots and factors

12. Fractional exponents

13. Simplifying radical expressions

14. Solving quadratic equations
    by factoring
    by completing the square
    use of quadratic formula

15. Negative exponents

16. Simplifying rational expressions

17. Solution of fractional equations and applications

Course Coordinator:
Gloria Woods
1997-98

Mathematics 104 **5 cr.** **Basic College Mathematics**
A, W, Sp, Su

Prerequisite:

Mathematics 050, or 075, or Course Code S or R on Math Placement Test. Not open to students with credit for 116, 130, or 148.

Catalog Description:

Systems of equations, arithmetic of polynomials, rational expressions, factoring, fractional equations, inequalities, exponents, quadratic equations, absolute values, functions and graphs.

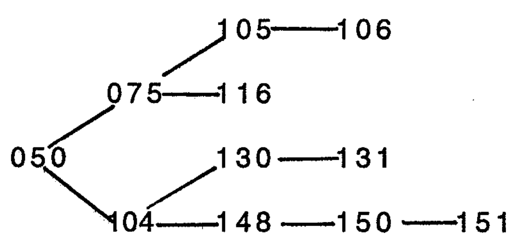
Purpose of Course:

To meet the needs of students entering the University with Course Code S on Math Placement Test, or with credit for 050. In addition, **students placing at Course Code R, and who need Math 148**, must take 104 prior to enrolling in 148. Completion of Math 104 is required for entry into some degree granting colleges.

Follow-up Course:

Math 148.

Sequencing Chart:



Text:

Intermediate Algebra, 3rd edition, Johnson & Steffensen, (Harper Collins)
most of chapters 2 - 8, 9.1-9.2

First used Autumn 1994, replacing the Phillips, Butts and Shaughnessy text.

(Over for Topics and Sample Syllabus)

Topics List & Sample Syllabus

Sections	Topics
2.2-2.7	Linear Equations and Inequalities
	Techniques of Problem Solving; Problem Solving Using Linear Equations
	Literal Equations; Solving Linear Inequalities
	Compound Inequalities; Absolute Value Equations and Inequalities
3.1-3.6	Graphs, Relations and Functions
	Graphing Equations in Two Variables; Linear Equations
	Slope of a Line; Forms of the Equation of a Line
	Review and 1st Midterm
	Relations and Functions
	Functional Notation and Special Functions
4.1-4.3	Systems of Linear Equations and Inequalities
	Systems of Two Linear Equations in Two Variables
	Solving Systems of Two Equations; Problem Solving Using Systems
5.3-5.6	Polynomials and Factoring
	Multiplication of Polynomials
	Common Factors and Grouping; Factoring Trinomials
	Special Formulas and Summary of Factoring Techniques
	Problem Solving Using Factoring
6.1-6.7	Rational Expressions
	Algebraic Fractions and Rational Expressions
	Multiplication and Division of Fractions
	Addition and Subtraction of Fractions
	Solving Fractional Equations; Problem Solving Using Fractional Equations
	Review and 2nd Midterm
	Simplifying Complex Fractions; Division of Polynomials
7.1-7.7	Radicals and Rational Exponents
	Roots and Radicals; Simplifying Radicals
	Multiplication and Division of Radicals; More Operations on Radicals
	Rational Exponents; Solving Radical Equations
	The Pythagorean Theorem & the Distance and Midpoint Formulas
8.1-8.2	Quadratic Equations and Inequalities
	Factoring and Taking Roots
	Completing the Square and the Quadratic Formula
	Review and 3rd Midterm
9.1-9.2	More On Functions
	Quadratic Functions
	Properties of Functions and Special Functions

Course Coordinator:
Paul Ponomarev
1997-98

Mathematics 105 **5 cr.** **Mathematics for Elementary Teachers I**
A, W

Prerequisite:

Mathematics 075 or 104, or Course Code L, M, N or R on Math Placement Test.

Catalog Description:

Development of basic ideas of arithmetic, algebra, and geometry as appropriate for elementary school teachers.

Purpose of Course:

To develop an appreciation of, and basic competency in, the use of analytical thought in the development of a cohesive body of useful mathematical knowledge, with special emphasis on topics encountered in the elementary school mathematics program. Math 105 deals with topics encountered in grades K - 4, and in particular introduces the whole number system, geometry, and combinatorial counting techniques. Math 106 introduces rational numbers and integers, congruent and similar triangles, and probability.

Follow-up Course:

Math 106

Text:

Mathematics for Elementary Teachers, 4th Ed., Musser & Burger.

and

OSU Math 105 Supplements/Labs

Topics:

Section	Topics
2.1, 2.2, 2.3	The number concept/counting
Supp. A, 13.2	Measurement with whole numbers
3.1, 3.3, 4.2	Addition and subtraction of whole numbers
Supp. B1-B4	Addition and subtraction in measurement
3.2,3.3,4.2,Supp B5	Multiplication and division of whole numbers
Supp. B6, 13.2	Measurement using whole number arithmetic
13.3, 13.4	Surface area and volume
11.2, Topic 3	Counting techniques
5.1, 5.2	Number Theory

Course Coordinator:
Joe Ferrar
1997-98

Mathematics 106 **5 cr.** **Mathematics for Elementary Teachers II**
Wi, Sp

Prerequisite:

Mathematics 105

Catalog Description:

Continuation of 105.

Purpose of Course:

To develop an appreciation of, and basic competency in, the use of analytical thought in the development of a cohesive body of useful mathematical knowledge, with special emphasis on topics encountered in the elementary school mathematics program. Math 105 deals with topics encountered in grades K - 4, and in particular introduces the whole number system, geometry, and combinatorial counting techniques. Math 106 introduces rational numbers and integers, congruent and similar triangles, and probability.

Follow-up Course:

Math 107

Text:

Mathematics for Elementary Teachers, 4th ed., Musser & Burger.

and

OSU Math 106 Supplements/Labs

Topics:

Section	Topics
6.1, 6.2, 6.3	Fractions
7.3, 11.1	Ratios/Probability
11.2, 11.3	More Probability
7.1, 7.2, 7.4	Decimals and percent
8.1, 8.2	Integers
9.1, 9.2	Rational and real numbers
Supp. C1-C5, 14.1	Deductive geometry
Supp. C6, 14.2, 14.3	Similar triangles/constructions
15.1, 15.2	Coordinate geometry

Note: Math 106 students will be expected to know and be able to apply basic area and volume formulas and concepts as covered in Math 105.

Course Coordinator:
Joe Ferrar
1997-98

Mathematics 107 **5 cr.** **Topics in Mathematics For Elementary Teachers**
Sp

Course now offered in Spring Quarters beginning Spring 1995; was formerly offered in Winters through Wi 1994

Prerequisite:

Mathematics 106

Catalog Description:

Further topics in mathematics selected by the instructor to broaden the mathematics perspectives of elementary teachers.

Topics:

Optional with instructor. Should closely relate to content of 105 and 106 and serve to tie together topics previously encountered. A problem-solving approach using microcomputers is highly appropriate.

Course Coordinator:
Joe Ferrar
1997-98

Mathematics 116 **5 cr.** **Survey of Finite Mathematics**
A, W, Sp, Su

Note: This course is in the process of changing the title and catalog description to fit the topics that are being taught. *This course will no longer be a traditional finite math course starting Autumn 97. The title and catalog description used are the ones that are listed in the 97-98 Course Catalog. See below for the proposed changes.*

Prerequisite:

Mathematics 075 or 076 or satisfactory score on Math Placement Test.

Catalog Description:

Topics from finite mathematics appropriate for non-physical sciences; including equations of lines, linear models, matrices, linear programming, and probability.

(This description first appeared in the 1995-96 University Bulletin)

Proposed Title: **Excursions in Mathematics**

Proposed Catalog Description:

Critical thinking & problem solving, with relevant topics met in everyday life; appropriate for non-physical sciences.

Purpose of Course:

The emphasis in this course is on intuitive understanding and developing some facility for applying mathematical ideas to problem solving. It is hoped that students may feel less intimidated by terminology and symbolism.

Follow-up Courses:

None. Math 116 is a terminal course.

Text:

Mathematics in Life, Society, and the World, by Parks, Musser, Burton, & Siebler(1997).

This is a new text used beginning Autumn 1997 replacing the Long and Graening text.

With this new text, the course has a different emphasis than did the 116 Finite Math course taught between Summer 1993 and Summer 1997 The course before the Summer of 1993 contained some algebra and had a much different emphasis than the course taught after Summer 1993.

(Over for Topics and Sample Syllabus)

Topics list

Section	Topics
1.1	Statements and Logical Connectives
1.2	Deduction
1.3	Categorical Symbolism
1.4	Problem Solving
2.1	Numeration Systems
2.2	Mental Math and Estimation
2.5	Solving Percent Problems
2.6	Integer Exponents
2.7	General Exponents
6.1	Interest
6.2	Loans
6.3	Amortized Loans
6.4	Buying a House
6.5	Annuities and Sinking Funds
3.1	Organizing and Picturing Data
3.2	Comparisons
3.3	Enhancement, Distraction, and Distortion
3.4	Means, Medians, and Percentiles
5.1	Computing Probabilities in Simple Experiments
5.2	Computing Probabilities in Complex
5.3	Conditional Probability, Independence, and Expected Value
11.1	Scaling of Length and Area
11.2	Similarity and Scaling
11.4	Scaling Physical Objects

Some possible additions if time permits.

7.1	Game Theory
7.2	Determined Games
9.1	Voting Systems
9.2	Flaws of Voting Systems
10.1	Tilings
10.2	Symmetry, Motions, and Escher Patterns
12.1	Fibonacci Numbers, the Golden Ratio, and Recursion
12.2	Geometric Recursion

Course Coordinator:
Tom Dowling
1997-98

Mathematics 117 | **5 cr.** | **Survey of Calculus**
A, W, Sp

Prerequisite:

Mathematics 116 or 130 or 148 or 150

Catalog Description:

An introduction to differential and integral calculus.

Purpose of Course:

Under the GEC the majority of the audience is made up of Architecture majors (who will have already taken 148 and 150) for whom the course is a requirement, with the balance being Exercise Science, Elementary Ed students doing a Math Concentration, and pre-GEC students from Arts & Sciences. The intent of the course is to introduce these students to the derivative and definite integral, using the slope of the tangent line or rate of change as a conceptual model for the derivative and area as a model for the definite integral. For this audience, graphical examination of these ideas is helpful.

Follow-up Courses:

There are really no follow-up courses. To start any other mathematics sequence will probably involve beginning at an appropriate entry level course. Students interested in further course work in mathematics should consult the mathematics counselors in 105 Mathematics Bldg.

Text:

Ernest F Haeussler,Jr. and Richard Paul, Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences (8th ed, 1996)

Effective Autumn 97, the course has returned to the more traditional text and approach. *From Autumn 93- Summer 97, the calculus reform text by Hughes-Hallet was used.*

(Over For Topics List And Sample Syllabus)

Topics List & Sample Syllabus

Section	Topics
11.1,11.2	Limits
11.5	Continuity Applied to Inequalities
12.1	Derivatives
12.2	Rules of Differentiation
12.3	The Derivative as a Rate of Change
12.5	Product , Quotient Rules
12.6	Power Rule
	Review and Midterm #1
13.1	Derivatives of Logarithmic Functions
13.2	Derivatives of Exponential Functions
13.4	Logarithmic Differentiation
14.1	Relative Extrema
14.2	Absolute Extrema on a closed Interval
14.3	Curve Sketching
14.4	Second Derivative Test
15.1	Applied Maxima and Minima
	Review and Midterm #2
16.1	The Indefinite Integral
16.2	Integration with Initial Conditions
16.3	More Integration Formulas
16.4	Techniques of Integration
16.7	The Fundamental Theorem of Calculus
16.8	Area
16.9	Area Between Curves
16.10	Consumers' and Producers' Surplus
17.3	Integration by Tables
	Review and Midterm #3
17.5	Approximate Integration.

Review and Final Exam

Course Coordinator:
Tom Dowling
1997-98

Mathematics 130 **4 cr.** **Math Analysis for Business I**
A, W, Sp, Su

Prerequisite:

Mathematics 075 or 076 or 104, or Course Code N on Math Placement Test.

Catalog Description:

Equations, inequalities, absolute value, functions, exponential and logarithmic functions, systems of equations, and matrix algebra, applications to business.

Purpose of Course:

To provide students with the pre-calculus mathematics needed in the Business program. The applications are business related.

Follow-up Course:

Math 131

Text:

Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Haeussler & Paul, 8th ed.

Topics:

Liner Equations, Equations Leading to Linear Equations	(1.1),(1.2)
Quadratic Equations	(1.3)
Applications of Equations, Linear Equations	(2.1), (2.2)
Applications of Inequalities	(2.3)
Functions, Special Functions	(3.1), (3.2)
Graphs in Rectangular Coordinates	(3.4)
Lines, Applications and Linear Functions	(4.1), (4.2)
Quadratic Functions	(4.3)
Systems of Linear Equations, Nonlinear Systems	(4.4), (4.5)
Applications of Systems of Equations	(4.6)
Exponential Functions, Logarithmic Functions	(5.1), (5.2)
Properties of Logarithms	(5.3)
Logarithmic and Exponential Equations	(5.4)
Compound Interest, Present Value	(8.1), (8.2)
Annuities, Amortization of Loans	(8.3), (8.4)

THE OHIO STATE UNIVERSITY
DEPT. OF MATHEMATICS
231 W. 18th AVE.
COLUMBUS, OHIO 43210

Course Coordinator
Gloria Woods
1997-98

Math 131 **4 cr.** **Mathematical Analysis for Business II**
A, W, Sp, Su

NOTE: The textbook for Wi 98 will be Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Hauessler/Paul, 8th ed.

Prerequisite:

Mathematics 130 or 148 or 150, or Course Code L on Math Placement Test. (Note: students who took 116 in Autumn 1993 or later are not prepared for 131.)

Catalog Description:

Matrices, determinants, linear programming, interpretation of graphs, modeling, applications.

Purpose of Course:

Math 131 is designed to introduce students in the College of Business to matrix algebra, calculus concepts, and related business applications. This course is problem oriented.

Text:(for Au 1997 only)

Mathematical Applications for the Management, Life, and Social Sciences, Harshbarger/Reynolds 5th Edition, and
Supplement for Math 131(from: A Companion to Calculus), Ebersole/Schattscheider/ et al.

Topics:

Introduction to Matrices	(2.1)
Multiplication of Matrices	(2.2)
Solving Systems of Equations	(2.3)
Inverse of a Square Matrix	(2.4)
Applications of Matrices	(2.5)
Linear Inequalities	(3.1, 3.2)
Linear Programming	(3.3)
Simplex Method of Maximization	(3.4)
Simplex Method of Duality and Minimization	(3.5)
Secant Lines, Tangent Lines	(1.7)
Lines Fitting Curves - Slopes	6-A
Velocity and Marginal Cost	6-B,6-C
Distance Traveled from Velocity Curve	19-A
Area of Regions with Piecewise Linear Bdy.	19-B
Reimann Sums	19-C

(see next page for Wi 98 changes)

Text:(for Wi, Sp 98)

Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Haeussler & Paul, 8th ed.

Topics:

Matrices	(6.1)
Matrix Addition and Scalar Multiplication	(6.2)
Matrix Multiplication	(6.3)
Method of Reduction	(6.4),(6.5)
Inverses	(6.6)
Determinants	(6.7)
Cramer's Rule	(6.8)
Applications	(6.9)
Linear Inequalities in Two Variables	(7.1)
Linear Programming	(7.2)
Multiple Optimum Solutions	(7.3)
The Simplex Method	(7.4)
Slope	(4.1),(12.1)
Rate Of Change	(12.3)
Summation	(16.5)
Area	(16.8)

Course Coordinator:
Phil Huneke
1997-98

Math 132 | **5 cr.** | **Mathematical Analysis for Business III**
Au, Wi, Sp, Su

NOTE: The textbook for Sp 98 will be Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Hauessler/Paul, 8th ed. The topics covered will be similar to those cover in Au and Wi.

Prerequisite:

Mathematics 130 or 150

Catalog Description:

Limits, derivatives of polynomial, logarithmic, and exponential functions, sigma notation, area under curves, the definite integral, and applications to business.

Text:

Mathematical Applications for the Management, Life, and Social Sciences, Harshbarger/Reynolds, 5th Edition.

Topics:

Limits	(9.1)
Limits at Infinity	(9.2)
Derivatives, Derivative Formulas	(9.3, 9.4)
Product and Quotient Rule	(9.5)
Chain and Power Rule	(9.6)
Using the Derivative, Higher Order Derivatives	(9.7, 9.8)
Applications of Derivatives in Business and Economics	(9.9)
Relative Maxima and Minima, Curve Sketching	(10.1)
Concavity, Points of Inflection	(10.2)
Optimization in Business and Economics	(10.3)
Application of Maxima and Minima	(10.4)
Derivatives of Logarithmic Functions	(11.1)
Derivatives of Exponential Functions	(11.2)
Related Rates	(11.4)
Applications in Business and Economics	(11.5)
Indefinite Integral	(12.1)
Power Rule	(12.2)
Integrals Involving Log and Exp Functions	(12.3)
Applications of Indefinite Integral in Business and Economics	(12.4)
Area Under Curve	(13.1)
Definite Integral, Fundamental Theorem of Calculus	(13.2)
Area Between Curves	(13.3)
Application of Definite Integral in Business	(13.4)
Using Tables of Integrals	(13.5)

For Further Information See:
Surinder Sehgal
1997-98

Mathematics 148: Au 97 **4 cr.** **College Algebra**
A, W, Sp, Su

Prerequisite:

Mathematics 104, or Course Code N on Math Placement Test.

Catalog Description:

Rational exponents, inequalities, functions, graphs of polynomial and rational functions, conic sections, zeros of polynomials.

Purpose of Course:

The course Math 148 consists of precalculus concepts and skills needed by the student entering the regular calculus sequence (151, 152, etc.). The purpose of the course is to prepare the student for the regular calculus sequence.

Follow-up Course:

Math 150

Text:

College Algebra and Trigonometry, Dwyer & Gruenwald.

Technology: All students are required to have a graphing calculator

Topics:

Polynomial Equations and Inequalities	(2.4)
Rational and Radical Equations and Inequalities	(2.6)
Functions	(4.1)
Graphs of Functions	(4.2)
Combinations and Inverses of Functions	(4.3)
Linear, Quadratic, and Piecewise Functions	(4.4)
Modeling with Functions and Variation	(4.5)
Polynomial Functions	(5.1)
Division of Polynomials	(5.2)
Quadratic Equations	(2.5)
Zeros and Factors of Polynomials	(5.3)
Real Zeros of Polynomials	(5.4)
Rational Functions	(5.5)
Trigonometric Functions of Acute Angles	(7.2)
Exponential Functions	(6.1)

(over for course changes in Wi 98)

Mathematics 148: Beginning Wi 98 A, W, Sp, Su **4 cr.** **Algebra and Trigonometry and Their Applications**

Prerequisite:

Mathematics 104, or Course Code N on Math Placement Test.

Catalog Description:

Applications from chemistry, physics, and biology involving integer and rational exponents, solving linear and quadratic equations, system of equations, trigonometry of acute angles, vectors and exponential equations.

Purpose of Course:

To help students make the transition from abstract mathematics to concrete applications, while at the same time reinforcing the algebra and trigonometry skills needed to proceed with more advanced mathematics.

Follow-up Course:

Math 150 for those students needing to take Math 151

Proposed Text:

Either they will use the College Algebra and Trigonometry by Dwyer & Gruenwald text or they will be using specially packaged portions of Algebra and Trigonometry and Their Applications, by L. J. Goldstein.

Topics

Weeks 1-2:	integer exponents, rational exponents, scientific notation, applications
Week 3:	solving equations in many variables, variation
Week 4:	linear equations, applications
Week 5:	systems of equations, applications
Week 6:	quadratic equations, applications
Week 7-8:	trigonometry of acute angles, applications
Week 9:	vectors, applications
Week 10:	exponential equations, applications

Course Coordinator:
Sia Wong
1997-98

Mathematics 150 **5 cr.** **Elementary Functions**
A, W, Sp, Su

NOTE: For autumn 1997, there is a slight modification in the topics of this course to make it more like a precalculus course. Also, the textbook for Wi 98 will be College Algebra and Trigonometry, Dwyer & Gruenwald.

Prerequisite:
Mathematics 148, or Course Code M on Math Placement Test.

Catalog Description:

Inverse functions, logarithmic, exponential and trigonometric functions, and their graphs; complex numbers.

Purpose of Course:

To learn the basic aspects of the elementary functions(rational, exponential, logarithmic, and trigonometric). Most students in this course plan to take the regular calculus sequence.

Follow-up Course:

Math 151 or Math 117

Text: (Au 97 only)

Fundamentals of Algebra and Trigonometry (8th edition), Swokowski and Cole.

Technology: All students are required to have a graphing calculator

Topics:

Graphs	(3.1-3.3)
Definition of a Function	(3.4)
Quadratic Functions	(3.6)
Operations on Functions	(3.7)
Polynomial Functions	(4.1-4.2)
Rational Functions	(4.5)
Exponential Functions	(5.1-5.2)
Logarithmic Functions	(5.3)
Properties of Logarithms	(5.4)
Exponential and Logarithmic Equations	(5.5)
Angles	(6.1)
The Trigonometric Functions	(6.2)
Graphs of the Trigonometric Functions	(6.3)
Trigonometric Functions of Angles	(6.4)
The Inverse Trigonometric Functions	(7.6)
Values of the Trigonometric Functions	(6.5)
Trigonometric Graphs	(6.6)
Applications Involving Right Triangles	(6.8)
Trigonometric Equations	(7.2)
Addition Formula	(7.3)
Double and Half Angle Formulas	(7.4)
The Law of Sines	(8.1)
The Law of Cosines	(8.2)

Course Coordinator:
Daniel B. Shapiro
1997-98

Mathematics 151 **5 cr.** **Calculus and Analytic Geometry**
A, W, Sp, Su

Prerequisite:

Mathematics 150 or Course Code L on Math Placement Test.

Catalog Description:

Limits, continuity, derivatives, Mean Value theorem, extrema, curve sketching, related rates, differentiation of the trig, log, and exponential functions.

Purpose of Course:

To provide students with a solid foundation in one-variable differential calculus.

Follow-up Course:

Math 152

Text:

Calculus, James Stewart, 3rd edition. (Beginning Au 95; the 2nd edition was used in 94-95)

Topics & Sample Syllabus:

Sections	Topics
1.1, 1.2	Tangent, velocity problems; Limit of a function
1.3	Calculating limits using the limit laws
1.4	The precise definition of a limit
1.5	Continuity
1.6	Tangents, velocities and other rates of change
2.1, 2.2	Derivatives; Differentiation formulas
2.3	Rates of change in Natural and Social Sciences
	Review and Midterm # 1
2.4	Derivatives of Trigonometric functions
2.5	The Chain Rule
2.6, 2.7	Implicit differentiation; Higher derivatives
2.8, 2.9	Related rates; Differentials/linear approximation
2.10	Newton's Method
3.1	Maximum and minimum values
3.2	The Mean Value Theorem
3.3	Monotonic functions and the First derivative Test
	Review and Midterm #2
3.4, 3.5	Concavity & points of inflection; Limits at infinity; Horizontal asymptotes
3.6	Curve sketching
3.7, 3.8	Graphing with Calculus and Calculators; Applied max/min problems
3.9	Applications to Economics
3.10	Antiderivatives
	Review and Midterm #3
	Review and Final Exam

Course Coordinator:
Zbigniew Fiedorowicz
1997-98

Mathematics 152 **5 cr.** **Calculus and Analytic Geometry**
A, W, Sp, Su

Prerequisite:
Mathematics 151

Catalog Description:

Integral, area, fundamental theorems of calculus, logarithmic and exponential functions, trigonometric and inverse trigonometric functions, methods of integration, applications of integration.

Purpose of Course:
To provide students with a solid foundation in one-variable integral calculus.

Follow-up Course:
Math 153

Text:
Calculus by James Stewart, 3rd edition. (Beginning Wi 96)

Topics & Sample Syllabus :

Sections	Topics
4.1,4.2	Sigma notation; Area
4.3,4.4	The definite integral; Fundamental Theorem of Calculus
4.5	The Substitution Rule
5.1,5.2	Areas between curves; Volume
5.3, 5.4	Cylindrical shells; Work
	Review and Midterm #1
6.1	Inverse functions
6.2	Exponential derivitives
6.3, 6.4	Logarithmic functions; Derivatives of log functions
6.5	Exponential Growth Decay
6.6,6.7	Inverse trig functions; Hyperbolic functions
	Review and Midterm #2
6.8	L'Hospital's Rule
7.1	Integration by parts
7.2,7.3	Trigonometric integrals; Trigonometric Substitutions
7.4	Integration by partial fractions
7.8	Approximate Integration
7.9	Improper Integrals
	Review and Midterm #3
8.2 & 8.3	Arc Length, Area of Surface of Revolution
8.4	Moments and Centers of Mass
8.1, 8.5, 8.6	Differential Equations, Pressure & Force, etc (Time permitting)
	Review and Final Exam

Course Coordinator:
Zbigniew Fiedorowicz
1997-98

Mathematics 153 **A, W, Sp, Su**	**5 cr.**	**Calculus and** **Analytic Geometry**

Prerequisite:

Mathematics 152

Catalog Description:

Indeterminate forms, Taylor's formula, improper integrals, infinite series, parametric curves and vectors in the plane; vectors, curves, and surfaces in space.

Purpose of Course:

To provide students with a solid foundation in calculus.

Follow-up Course:

Math 254

Text:

Calculus, by James Stewart, 3rd edition. (Beginning Sp 96)

Topics List & Sample Syllabus:

Sections	Topics
9.1, 9.2	Parametric curves; tangents and areas
9.3	Arc length and surface area
9.4	Polar coordinates
9.5	Areas and length in polar coordinates
9.6	Conic sections
9.7	Conic sections in polar coordinates
	Review and Midterm #1
10.1	Sequences
10.2	Series
10.3, 10.4	Integral test; Comparison tests
10.5	Alternating series
10.6	Absolute convergence, root and ratio tests
10.7	Strategy for testing series
10.8, 10.9	Power series; Representation of functions as power series
10.10	Taylor and Maclaurin series
10.11	Binomial series
10.12	Applications of Taylor polynomials
	Review and Midterm #2
11.1, 11.2	Three-dimensional coordinate systems; vectors
11.3	Dot product
11.4	Cross product
11.5, 11.6	Equations of lines and planes; Quadric surfaces
11.10	Cylindrical and spherical coordinates
	Review and Midterm #3
	Review and Final Exam

Course Coordinator:
Phil Huneke
1997-98

Mathematics 254 **5 cr.** **Calculus and Analytic Geometry**
Au, Wi, Sp, Su

Prerequisite:

Mathematics 153

Catalog Description:

Partial differentiation, Lagrange multipliers, multiple integrals, line integrals, and Green's Theorem

Purpose of Course:

To provide students with a solid foundation in calculus.

Text:

Calculus by James Stewart, 3rd ed.

Topics & Sample Syllabus

Sections	Topics
12.1	Functions of several variables
12.2	Limits and continuity
12.3	Partial derivatives
12.4	Tangent planes and differentials
12.5, 12.6	Chain rule; Directional derivatives and the gradient vector
12.7, 12.8	Maximum and minimum values; Lagrange multipliers
	Review and Midterm #1
13.1, 13.2	Double integrals; Iterated integrals
13.3	Double integrals over general regions
13.4	Double integrals in polar coordinates
13.5	Applications of double integrals
13.6	Surface area
13.7, 13.8	Triple integrals; Triple integrals in cylindrical and spherical coordinates
13.9	Change of variable in multiple integrals
	Review and Midterm #2
14.1	Vector fields
14.2	Line integrals
14.3	Fundamental Theorem for line integrals
	Review and Midterm #3
14.4	Green's Theorem
	Review and Final Exam

Course Coordinator:
Phil Huneke
1997-98

Mathematics 151C	**5 cr.**	**Calculus and Analytic Geometry**
Mathematics 152C	**5 cr.**	
Mathematics 153C	**5 cr.**	
Mathematics 254C	**5 cr.**	
Au, Wi, Sp		

Prerequisite:

The prerequisites are the same as those for 151, 152, 153, 254. e.g. for 151C the prerequisite is Math 150 or satisfactory score on the mathematics placement test.

Catalog Description:

The catalog descriptions are the same as those for 151,152,153,254.

Purpose of Course:

This sequence, Calculus & Mathematica, covers the material of Math 151,152,153, and 254 in a tutorial fashion, using an electronic "living" textbook on MacIntosh computers. The powerful graphing and symbolic manipulation available on microcomputers allows for upgrading the standard calculus courses to provide deeper insights than were previously possible. There are no lectures, only extensive tutorial sessions. Students work in the math lab for about two hours per day with supervision and help from faculty and graduate teaching assistants. There is also a weekly discussion session. Math 151C is open to Course Code L freshmen who have the attitude and interest to commit themselves to the course.

Follow-up Course:

After finishing 254C, students will be ready to move on to courses in differential equations or linear algebra. Additional Mathematica courses - 255C, 415C, and 513C - are now offered occasionally.

Text:

Calculus & Mathematica, Davis, Porta & Uhl, Addison-Wesley, 1994.

For 151C: Calculus & Mathematica: Derivatives
For 152C: Calculus & Mathematica: Integrals
For 153C: Calculus & Mathematica: Approximations
For 254C: Calculus & Mathematica: Vector Calculus

For further information see:
William Davis
1997-98

Mathematics 161 Au **5 cr.** **Accelerated Calculus and Analytic Geometry**
Mathematics 162 Wi **5 cr.**
Mathematics 263 Sp **5 cr.**

Catalog Descriptions:

Although the below are still the catalog descriptions, they do not accurately reflect the current arrangement of material in these courses. See the "Topics" section below for a more accurate description.

161: Functions, limits and continuity, derivatives, applications of the derivative, the integral, inverse functions.

162: Techniques of integration; improper integrals; applications of the integral; polynomial approximations and Taylor's Theorem; infinite sequences and series; tests for convergence; vectors, lines and planes.

263: Multivariable calculus (vector approach), line and surface integrals, vector differential operators.

Prerequisite:

Math 161--- Course code L placement and high school calculus.
Math 162--- 161 or written permission of department.
Math 263--- 162 or written permission of department.

Purpose of Course:

The three course sequence, 161-162-263, is equivalent in content to the four course sequence 151-152-153-254. This accelerated sequence is designed for able students who are willing to learn some of the topics outside of class. As taught since Autumn 1990, 161 serves as a substitute for 151 and 152, 162 as a substitute for 153, and 263 substitutes for 254.

Follow-up Course:

Courses in differential equations or linear algebra (after completing 263).

Text:

Calculus with Analytic Geometry, G. Simmons.

NOTE: The textbooks for the Math 161 sequence and Math 151 sequence are not the same.

Topics:

Math 161 will assume mastery of the computational aspects of polynomial and trigonometric differentiation, and will concentrate on integral calculus of the polynomial, logarithmic, exponential, trigonometric and inverse trigonometric functions, integration techniques, and applications.

Math 162-Sequences and series, power series, Taylor's theorem, convergence tests, vectors, dot and cross product.

Math 263-Vectors, surfaces, cylindrical and spherical coordinates, partial derivatives, multiple integrals, line integrals, vector fields, Green's theorem.

Course Coordinator:
Henry Glover
1997-98

Mathematics H161 Au 5 cr.
Mathematics H162 Wi 5 cr.
Mathematics H263 Sp 5 cr.

Accelerated Calculus and Analytic Geometry

Catalog Description:

The catalog descriptions for H161, H162, and H163 are the same as those for 161,162, and 263 (respectively)-see listing for those courses.

HOWEVER-these descriptions as currently listed in the University Bulletin are <u>*not correct;*</u> *for a more accurate description of their content, see "Topics" section below.*

Prerequisite:

H161--Credit for Math 151, or satisfactory score on Department Qualifying Exam.
H162--H161 with a grade of C or better or written permission of Honors Committee chair.
H263--H162 with a grade of C or better or written permission of Honors Committee chair.

Purpose of Course:

This sequence is the honors version of the accelerated calculus sequence 161,162,263; it is *designed for students with credit for Math 151.* These courses are taught daily by faculty members in small classes with considerable student-teacher interaction. Students in this sequence will be held to higher standards of mathematical rigor than those in non-honors versions; they will be expected to demonstrate mastery of definitions and statements and proofs of theorems. Math H161 is a substitute for 151 and 152, H162 for 153, and H263 for 254.

Follow-up Course:

After completing H263, students will be ready for Math H520 (or any other course in differential equations or linear algebra).

Text:

<u>Calculus with Analytic Geometry,</u> Simmons (same text as used for 161-162-263).

NOTE: The textbooks for the Math 161 sequence and Math 151 sequence are not the same.

Topics:

H161 will assume mastery of the computational aspects of polynomial and trigonometric differentiation, will briefly review the Mean Value Theorem, and will concentrate on integral calculus of the polynomial, logarithmic, exponential, trigonometric and inverse trigonometric functions, integration techniques, and applications.

H162-Sequences and series, power series, Taylor's theorem, convergence tests, vectors, dot and cross product, arc length, space curves.

H263-Vectors, parametric equations, surfaces, cylindrical and spherical coordinates, partial derivatives, multiple integrals, line integrals, vector fields, Green's theorem, Divergence theorem, Stokes' theorem.

For Further Information See:
V. Bergelson (Honors)
1997-98

Mathematics	**H190**	**Au**	**5 cr.**	**Elementary Analysis I**
	H191	**Wi**		**Elementary Analysis II**
	H264	**Sp**		**Elementary Analysis III**

Catalog Descriptions:

H190--Special course for superior students.

H191--Continuation of H190.

H264--Continuation of H191; a rigorous treatment of multivariable integrals including gradients, multiple integrals, line and surface integrals, Green's theorem, the divergence theorem, and Stokes' theorem.

Prerequisite:

H190 - Permission of department
H191 - A grade of C or better in H190
H264 - A grade of C or better in H191

Purpose of Course:

This three-quarter sequence comprises the most intensive first year honors track in mathematics. It is designed to challenge talented, highly motivated students, regardless of their chosen major area of study. The courses introduce students to the mathematical underpinnings of calculus and stimulate the development of mathematical thinking, in addition to covering the material of the traditional calculus sequence. This sequence will substitute for Math 151, 152, 153, 254, and 551. H190 - H191 fulfill the analysis requirement for a Math major. The sequence is taught by faculty members in small sections with considerable teacher-student interaction.

Follow-up Sequence:

Math H520, H521, H522

Texts:

Calculus, Spivak, 3rd. ed -for H190, H191.
Vector Calculus, 3rd. ed., Marsden and Tromba -for H264

Topics:

H190 - H191: Properties of real numbers. Mathematical induction. Definition of integral. Integrals of polynomials and trigonometric functions. Applications. Continuity, limits, derivatives and applications. Fundamental Theorem of Calculus and integration techniques. Taylor series. Sequences and series of numbers and functions. Uniform convergence. Power series. If time permits, some differential equations or complex-valued functions.

H264: Multivariable calculus (vector approach), gradients, multiple integrals, line and surface integrals, Green's Theorem, divergence theorem, Stokes' Theorem.

For Further Information see:
V. Bergelson (Honors)
1997-98

SPECIAL CALCULUS OPTIONS 1997-1998

1) Math 140, 141

140-Au 97, 141-Wi 98

Purpose: This two quarter calculus-with-review was first offered on a pilot basis in 1993-94. The class is intended for first quarter students who (i) needed Math 151 or higher for their intended major, (ii) placed at level N (and thus would otherwise have to take three math classes to get through Math 151), and (iii) took 4 or more years of college preparatory mathematics in high school. This special sequence gives these students an opportunity to move ahead more quickly by studying precalculus and calculus together.

Prerequisite: Level N placement (i.e. placement into Math 148) and 4 years of college preparatory math in high school.

Text: Stewart, Calculus, 3rd edition. This is the same book as used in 151-152.

Topics: By the end of 141, the sequence covers the equivalent of the topics in limits, derivatives, and applications of derivatives that are done in 151. The standard precalculus topics are studied as they became necessary for the calculus topics.

Follow-up Course: 152 for students successfully completing both 140 and 141. Students failing either course or dropping out of the sequence at any time must meet with the course instructor or the math counselors for rerouting specific to their situation.

Note: In 1994-95, there were separate sections, 194E and 151E, which were these same courses for ENG students. In 95-96 there was only 194X/151X.

For Further Information See:
Bostwick Wyman, Joe Ferrar
1997-98

2) Math 161G, 162G, 263G

161G - Au 97, 162G - Wi 98, 263G - Sp 98

Purpose: These classes are part of the College of Engineering's Gateway Program, in which selected students studied core topics for the engineering curriculum in an integrated format. In 1993-94, the calculus was included with engineering mechanics in the classes ENG 194A, 194B, 194C. In 1994-95 they were offered as Math 194D, 194F, 194G. For 95-96 and 96-97 the third quarter was 294G.

Prerequisite: Students are individually chosen by the College of Engineering.

Text: Calculus with Analytic Geometry, (2nd ed.), Simmons
Formerly used the Stewart text

Topics: Generally, the first quarter does the equivalent of 151, half of 152 and a small part of 153. (For example, in Au 94, MATH 194D covered (in the 2nd edition of Stewart): most of chapters 1-5 (skipping 1.4, 2.3, 3.7, 3.10, 5.5), then 9.4-9.5, 8.2, and 8.4. Generally the second quarter covers the rest of 152 and half of 254; and the third quarter does the rest of 153, the rest of 254, and some additional topics. The coverage will be similar this year.

For Further Information See:
Nela Lakos
1997-98

Mathematics 194A
offered Au 97

2 cr.

Group Studies in Mathematics

Catalog Description:

Designed to give groups of students an opportunity to pursue special studies not otherwise offered.

This catalog description applies to all Math 194's, but each 194 is different. All other 194 classes (except 194A) for 1995-96 are described on the "Special Calculus Options" pages. Math 194A is the only 194 planned for 1995-96 that is not a calculus course.

Prerequisite:

This special course is open only to first-quarter Course Code T students. Such students must have had at least 3 years of college preparatory mathematics while in high school.

Purpose of Course:

This was a pilot project to offer a supplement for Course Code T students (who normally must take Math 050) using interactive learning. Enrollment in 194A enabled these students to concurrently enroll in Math 104, instead of 050. Math 194A has now been offered in Au 94, Au 95, and Au 96.

Follow-up course:

Students in 194A who also successfully complete 104 are then eligible for 116, 130 or 148.

Text:

Materials as chosen by instructor or Course Coordinator.

Topics:

Topics are chosen to supplement the students' background for material they will study in 104.

Please Note: This information only applies to Math 194A. For information on other 194's offered 1995-96, see "Special Calculus Options".

Course Coordinator:
Harry Allen
1997-98

Mathematics 255 **A, W, Sp, Su**	**5 cr.**	**Differential Equations** **and Their Applications**

Prerequisite:

Mathematics 254. Not open to students with credit for 256, 415, or 556.

Catalog Description:

Basic concepts and methods in solving ordinary differential equations, first and second order, linear differential equations, series solutions, numerical methods, Laplace transforms, physical applications.

Purpose of Course:

This course is an introduction to the most basic concepts and methods in solving ordinary differential equations. The emphasis of this course is on problem-solving. Upon completion of this course students should know some applications of ordinary differential equations in engineering, physics and some other branches of the sciences.

Text:

Elementary Differential Equations and Boundary Value Problems (6th edition), Boyce and DiPrima; Chapters 2, 3, 4, 5, 6.

Suggested Syllabus

Chapters	Topics	Approximate Time
2.1-2.5, 2.8-2.9	First Order Differential Equations	1-2 weeks
3.1-3.7	Second Order Linear Equations	1-2 weeks
4.1-4.3	Higher Order Linear Equations	1 week
5.1-5.8	Series Solutions of Second Order Linear Equations	2 weeks
6.1-6.5	The Laplace Transform	2 weeks

Review and additional topics can be added as time permits.

Course Coordinator:
Yuval Flicker
1997-98

Mathematics 345 **4 cr.** **Foundations of Higher Mathematics**
Au, Sp

Prerequisite:

Mathematics 254.

Catalog Description:

Designed to prepare students for higher mathematics: an introduction to logic, proof techniques, set theory, number theory, integers, real numbers, transfinite numbers.

Purpose of Course:

Math 345 is intended to teach students the language of mathematics, to teach them the role of definitions in mathematics, to teach them how to read and write simple proofs, and to provide them with a conceptual framework for the study of higher mathematics.

In calculus, students are expected mainly to learn and apply computational skills. In upper division math courses, especially in those which are aimed primarily at math majors, students need to be familiar with the concepts of proof and generalization. Math 345 is a transitional course intended to follow calculus (254 or 263) and precede introductory analysis (547) and algebra (580). Students may also find Math 345 helpful as preparation for probability (530), topology (560), linear algebra (568 or 571), number theory (573), geometry (574) and combinatorial mathematics and graph theory (575).

Text:

The Fundamentals of Higher Mathematics, Falkner

Other useful references:

Theory and Problems of Set Theory and Related Topics (Schaum's Outline), Lipschutz.

How to Read and Do Proofs, Solow.

The Foundations of Mathematics, Stewart and Tall.

Course Coordinator:
Neil Falkner
1997-98

Mathematics 366 **3 cr.** **Discrete Mathematical Structures I**
A, W, Sp, Su (1st Term)

Prerequisite:

Mathematics 132 or 152.

Catalog Description:

Mathematical formalization and reasoning, logic, Boolean algebra; sets, functions, relations, recursive definitions, mathematical induction; elementary counting techniques.

Purpose of Course:

To provide the foundation for a deeper understanding of the conceptual tools in computer science. Computers, however, are not used in this course. The desire of the CIS faculty is that the course present math in rigorous form and require students to deal with abstract systems and mathematical proofs.

Follow-up Course:

Math 566.

Text:

Discrete Mathematics with Applications, S. S. Epp, 2nd edition

(Over for Topics)

Course Coordinator:
Randall Dougherty
1997-98

Topics:

Chapter 1 The Logic of Compound Statements
1.1 Logical Form and Logical consequence
1.2 Conditional Statements
1.3 Valid and Invalid Arguments
1.4 Application: Digital Logic Circuits

Chapter 2 The Logic of Quantified Statements
2.1 Predicates and Quantified Statements I
2.2 Predicates and Quantified Statements II
2.3 Arguments with Quantified Statements

Chapter 3 Elementary Number Theory and Methods of Proof
3.1 Direct Proof and Counterexample I: Introduction
3.2 Direct Proof and Counterexample II: Rational Numbers
3.3 Direct Proof and Counterexample III: Divisibility
3.4 Direct Proof and Counterexample IV: Division into Cases and the Quotient-Remainder Theorem
3.6 Indirect Argument: Contradicton and Contraposition

Chapter 4 Sequences and Mathematical Induction
4.1 Sequences
4.2 Mathematical Induction I
4.3 Mathematical Induction II
4.4 Strong Mathematical Induction and the Well-Ordering Principle

Chapter 5 Set Theory
5.1 Basic Definitions of Set Theory
5.2 Properties of Sets
5.3 The Empty Set, Partitions, Power Sets, and Boolean Algebras

Chapter 7 Functions
7.1 Functions Defined on General Sets
7.3 One-to-One and Onto, Inverse Functions
7.5 Composition of Functions

Chapter 10 Relations
10.1 Relations on Sets
10.2 Reflexivity, Symmetry, and Transitivity
10.3 Equivalence Relations
10.5 Partial Order Relations

Further topics if time permits:

Chapter 8 Recursion
8.1 Recursively Defined Sequences
8.2 Solving Recurrence Relations by Iteration
8.4 General Recursive Definitions

Chapter 6 Counting
6.1 Counting and Probability
6.2 Possibility Trees and the Multiplication Rule
6.3 Counting Elements of Disjoint Sets: The Addition Rule
6.4 Counting Subsets of a Set: Combinations

Course Coordinator:
Randall Dougherty
1997-98

Mathematics 415 **4 cr.** **Ordinary and Partial Differential Equations**
A, W, Sp, Su

Prerequisite:

Mathematics 254

Catalog Description:

Ordinary, partial, linear and non-linear differential equations. Fourier series, boundary value problems and Bessel functions.

Purpose of Course:

To master the standard techniques of elementary ordinary differential equations, Fourier series, and separation of variables in partial differential equations. It is a combination of 255 (Differential Equations) and 512 (Fourier Series and Boundary Value Problems).

Text:

1 1.1, 2.5: Introduction to Differential Equations and some Applications: Cooling, Compound Interest, and/or Mixing. (The instructor should just introduce one or more applications as lecture time permits.)
2 2.1, 2.2: Linear First Order ODE's & Integrating Factors
3 2.5 Applications from Lecture 1 revisited
4 2.7, 2.3: Applications: Mechanics: Separable Equations
5 2.3, 2.7 (cont.); 2.6: Population Growth
6 2.6 (cont.): 2.4: Differences Between Linear and Nonlinear Equations
7 2.4 (cont.): Bernoulli's Equation (p. 33, Sec. 2.2); Review (if time)
8 **MIDTERM I** (2.1 - 2.7)
9 3.8, 3.1: Vibrations; Homogeneous Eqns. with Constant Coefficients
10 3.2, 3.3: Fundamental Solutions, Linear Independence, Wronskian
11 3.2, 3.3: (cont.); Review Properties of Complex Numbers (Handout)
12 3.4, 3.5: Complex Roots and Repeated Roots of Characteristic Eqn.
13 3.4, 3.5: (cont.): Reduction of Order
14 3.8, 3.9: Vibrations Revisited and demonstrate that Forced Vibrations are modeled by Nonhomogeneous Equations
15 3.6: Nonhomogeneous Equations: Method of Undetermined Coefficients (Do not do polynomials times exponentials or polynomials times sin's or cos's.)
16 3.7: Nonhomogeneous Equations: Variation of Parameters
17 3.9: Forced (Undamped) Vibrations; Damped Vibrations (if time)
18 **MIDTERM II** (Chapter 3)
19 5.1: Review of Power Series
20 5.2: Examples (2 or 3) of Series Solutions near an Ordinary Point
21 10.1: Heat Conduction & Separation of Variables
22 10.2, 10.3: Fourier Series, Fourier Theorem
23 10.4, 10.5: Even and Odd Functions; Heat Eqn. (Again).
24 10.5 (cont.)
25 **MIDTERM III** (5.1,5.2 and 10.1 - 10.5)
26 10.5 (cont.): Other Boundary Conditions for the Heat Equation
27 10.6: The Wave Equation: Vibrations of an Elastic String
28 10.7: Laplace's Equation
29 10.7 (cont.): Laplace's Equation and Review (if time)

FINAL EXAM (1.1, 2.1-2.7, Chap. 3, 5.1-5.2, 10.1-10.7)

THE OHIO STATE UNIVERSITY

Mathematics 416 **5 cr.** **Vector Analysis and Complex Variables**
Au

NOT CURRENTLY OFFERED
This course has not been on the Master Schedule since Autumn 1993. It was on the Master Schedule for Autumn 1992 and Autumn 1993, but did not run either year due to low enrollment. The course is no longer required for AAE majors.

Prerequisite:

Mathematics 254

Catalog Description:

Vector algebra and vector operators, line integrals, analytic functions, complex integral theorems, power series, residues, and conformal mapping.

Purpose of Course:

The course is an option in some engineering programs (mainly Engineering Physics). Minimal proofs or intuitive explanations should be the rule (e.g., Cauchy Theorem by Green's Theorem rather than Cauchy-Goursat). The vector analysis portion should be covered first. This course is a combination of 513 (vector calculus) and 514 (complex variables).

Texts:

Complex Variables, Churchill, Brown
Chapters 1 - 7

Schaum's Outline: Vector Analysis.
Chapters 1 - 6

Course Coordinator:
Not Currently Offered
1997-98

Mathematics H487 **2 cr.** **Advanced Problem Solving**
Mathematics H187
Au

Prerequisite:

Permission of Department.

Catalog Description:

An advanced enrichment course for interested and capable students.

Purpose of Course:

To offer an experience in problem solving in mathematics for interested and talented students beyond what they would encounter in a standard program. This course is repeatable to a maximum of 6 credit hours, and is graded S/U. This course may not be counted in a major or minor program in Mathematics.

Topics:

Interesting special problems as chosen by the instructor.

Math H187 is often combined with Math H487. In Autumn 1994, they ran as separate courses.

For Further Information See:
V. Bergelson (Honors)
1997-98

Mathematics 504 **5 cr.** **History of Mathematics**
Sp

Prerequisite:

Mathematics 580 or 568 or 507, or permission of department.

Catalog Description:

Development of mathematics from primitive origins to present form; topics include: development of arithmetic, algebra, geometry, trigonometry, and calculus.

Purpose of Course:

This course is an introduction to the history of mathematics.
The course now has a two-fold purpose:

(i) expose the students to the good mathematics of yesteryear (while placing the evolution of mathematics in a historical setting);

(ii) the course will be submitted as a Third-Level Writing Course for math majors. Oral presentations, short essays, and a long final paper may be requested.

Texts:

Mathematical Thought From Ancient to Modern Times (3 vols.).
A History of Mathematics - An Introduction, Victor J. Katz.

Texts used in the past include:

An Introduction to the History of Mathematics, 4th edition, Howard Eves
A History of Mathematics, Carl B. Boyer and Uta Merzbach
The Historical Development of Calculus, C. H. Edwards, Jr.
Mathematics and its History, Stillwell.

Topics and Assignments:

The topics and assignments will vary based on the instructors.

For example, as taught Spring 1994, the class included problems assigned (and then covered in recitations) from most sections covered in the text, and also a term paper on a topic chosen by the student. In Sp 94 the class covered primarily Part Three of the Katz text (Chapters 9,10,11,12, covering roughly 1400-1700) with some supplementary material on other periods. The term paper was submitted once as a first draft, then returned to the students who completed it by the end of the quarter.

Course Coordinator:
B. Wyman
1997-98

Mathematics 507 **5 cr.** **Advanced Geometry**
A, W

Prerequisite:

Mathematics 152

Catalog Description:

Advanced topics from Euclidean Geometry.

Purpose of Course:

To expand on the standard high school geometry curriculum, introducing related topics such as hyperbolic geometry to clarify and illustrate the special role played by Euclidean geometry.

Text:

Euclidean & Non-Euclidean Geometries, Greenberg, 3rd edition.

Topics:

1. Development of the axiom system underlying Euclidean geometry.
2. Investigation of the Euclidean and Hyperbolic parallel axioms.
3. Models of Hyperbolic Geometry

Course Coordinator:
Joe Ferrar
1997-98

Mathematics 510.01 510.02 510.03 **2-5 cr.** **Topics in Mathematics for Elementary School Teachers**

Au, Wi, Sp, Su (listed this way in catalog - but see below)

Two sections of 510 were offered in Summer 1994. The last previous offering of any 510 was in Au 91.

Prerequisite:

One year teaching experience or permission of instructor.

Catalog Description:

Special topics in mathematics appropriate for teachers in the primary and intermediate grades. Repeatable to a maximum of 10 credit hours for each decimal subdivision with written permission of department.

Topics:

510.01 Geometry

510.02 Properties of Numbers

510.03 Numerical Methods

Audience

Designed for in-service teachers.

Course Coordinator:
Not Currently Offered
1997-98

Mathematics 512
A, W, Sp, Su (1st Term)

3 cr.

Partial Differential Equations and Boundary Value Problems

Prerequisite:

Mathematics 255 or 415 or 556.

Catalog Description:

Fourier series, orthogonality relations, vibrating string, steady state heat, Laplace transform, and applications.

Purpose of Course:

This course develops problem solving skills with little emphasis on theory. Derivation of the partial differential equations from the physical models is not necessary. Students should be able to solve the PDE's and ODE's and interpret the solution.

Text:

Advanced Engineering Mathematics, 7th ed., Kreyszig

Sample Syllabus: (Categories 1, 2, 3 MUST be covered)

1. Fourier Series: 8 days including a test.
Sections 10.1 - 10.5, 10.7. Optional: 10.6 and 10.7.

2. Partial Differential Equations: 8 days including a test.
Sections 11.1, 11.3-11.5. Only rectangular coordinates are considered. The text is a bit skimpy in the variety of examples and contexts in which separation of variables is used, especially with regard to Laplace's equation. It should be augmented somewhat.

3. Laplace Transform: 9 days including a test. Sections 6.1-6.8

4. Application of Laplace transform to PDE's (or other applications). Optional. 3 days. Section 11.13.

Course Coordinator:
George Majda
1997-98

Mathematics 513 **3 cr.** **Vector Analysis for Engineers**
Au, Wi

Prerequisite:

Mathematics 254

Catalog Description:

Vector algebra, vector operators, line integrals, vector integral theorems, curvilinear coordinates; applications.

Purpose of Course:

A "skills" course designed to give familiarity with vector notation, vector operations, line and surface integrals and the main theorems of vector calculus.

Texts:

There are three possibilities:

1) Introduction to Vector Analysis, Davis and Snider, 6th edition (used 93-94 through 95-96)
2) Advanced Engineering Mathematics, Kreyszig (6th edition of Kreyszig was used 92-93)
3) Div, Grad, Curl and All That, Schey; and Schaum's outline Vector Analysis

Sample Syllabus:

This syllabus is based on the Davis and Snider text. (Note: This book is too verbose, and some selectivity will be required. But it has many extra ideas and good descriptions of the meanings of the quantities studied.)

Chapter 1: 3 days
Review vector algebra, geometry, dot and cross products, lines and planes.
Sections 1-12, 14.

Chapter 2. 5 days
Vector functions of one variable, arc length, velocity acceleration, curvature.
Sections 1-3 (4 optional).

Chapter 3. 3 days
Vector and scalar functions. Chain Rule. Divergence, Gradient and Curl. Directional Derivative, normals and tangent planes.
Sections 1, 3-6.

Chapter 4. 15 days
Line integrals, potentials, surfaces, surface integrals. Green's Theorem, the Divergence Theorem and Stokes' Theorem. Potentials. Applications.
Sections 1-4, 8-12, 15, 16.

Or (different text):
Using Kreyszig, cover Chapters 8 and 9. This text is too terse and must be augmented slightly. (e.g. using Schaum's Outline)

Course Coordinator:
George Majda
1997-98

Mathematics 514 **3 cr.** **Complex Variables for Engineers**
Sp

Prerequisite:

Mathematics 254

Catalog Description:

Introduction to complex variables, analytic functions, complex integral theorems, power series, residues, conformal mapping.

Purpose of Course:

This is a "skills" course. Subject matter is needed in Engineering courses. Some time on line integrals may be saved, and Green's Theorem may be used to get the Cauchy integral theorem, since these topics have been covered in Math 254.

Text:

Complex Variables and Applications, Churchill, 5th edition (used Sp 93, Sp 94, Sp 95), or
Advanced Engineering Math, Kreyszig, 7th edition

Kreyszig contains much diverse material. It is an excellent reference for engineers on many topics in mathematics.

Each text has too much material, so it is helpful to give a review sheet before tests. Use the text for reference and use the lectures to make the text understandable.

Sample Syllabus #1 Based on Churchill:	Days
1. Complex numbers, polar form	3
2. Analyticity, Cauchy-Riemann equations	3
3. Elementary functions	4
TEST	
4. Mapping by elementary functions	3
5. Cauchy integral theorem and consequences	5
TEST	
6. Power series	3
7. Residues, definite integrals	6

Sample Syllabus #2 Based on Kreyszig: (2 tests and a final exam)

1. Complex analytic functions	9
2. Complex integrals	5
3. Power Series, Taylor and Laurent Series	4
4. Integration by residues	6
5. Conformal Mapping (omit 16.5)	4

6. Complex functions and potential theory: only if you have some time left over and the students are well-versed with the above material.

Course Coordinator:
George Majda
1997-98

Mathematics	**H520 Au** **H521 Wi** **H522 Sp**	**5 cr. each**	**Linear Algebra** **Differential Equations** **Complex Analysis**

Prerequisite:

H520 H263 with a grade of C or better or H 264 with a grade of C or better, or written permission of Honors Committee chairperson. Not open to students with credit for H290.

H521 H520 with a grade of C or better or written permission of Honors Committee chairperson. Not open to students with credit for H291

H522 H521 with a grade of C or better or written permission of Honors Committee chairperson. Not open to students with credit for H292

Catalog Description For H520:

Vector spaces, linear transformations, systems of equations, determinants, eigenvalues, spectral theorem, Cayley-Hamilton theorem.

Catalog Description For H521:

Ordinary, linear and nonlinear differential equations, existence and uniqueness theorems, Fourier series, boundary value problems, systems, Laplace transforms, phase space, stability and periodic orbits.

Catalog Description For H522:

Analytic functions, Cauchy integral theory, residue calculus, series representations, conformal mapping. The sequence H520-H521-H522 substitutes for 568 and 569; 255 or 415; 416 or 514 or 552

Purpose of Course:

This three quarter sequence is the second year of the honors program in mathematics. It is designed to challenge talented, highly motivated students, regardless of their chosen major. This sequence substitutes for Math 568 and 569, Math 255 or 415, and Math 514 or 552; the level of rigor is higher than in any of these classes. It is taught by faculty members in small sections with considerable teacher-student interaction.

Texts vary, for example:

Strang, Linear Algebra and Its Applications
Friedberg, Linear Algebra, 2nd Edition (used in H520, Au 93, Au 94 and Au 95)
Simmons, Differential Equations with Applications and Historical Notes (used in H521, Wi 94)
Marsden and Hoffman, Basic Complex Analysis, 2nd Edition
Boas, Invitation to Complex Analysis (used in H522, Sp 94)

Course Coordinator:
V. Bergelson (Honors)
1997-98

Mathematics 530 **3 cr.** **Probability I**
Au

Prerequisite:

Mathematics 254. Not open to students with credit for Statistics 520.

Catalog Description:

Combinatorial probability, random variables, independence, expectations, variance, limit theorems.

Purpose of Course:

To introduce students to the fundamentals of probability theory and to teach them how to apply these fundamentals to solve problems.

Follow-up Course

Math 531 if it is offered.

Text:

Probability, Jim Pitman.

Topics:

Sets
Counting
Independence and conditioning
Limit theorems
Probability
Random Variables
Mean, variance

Course Coordinator:
Neil Falkner
1997-98

Mathematics H540 **5 cr.** **Geometry and Calculus in Euclidean Spaces and on Manifolds I**
Wi*

*** OFFERED IN ODD YEARS ONLY (Wi 1993, Wi 1995, Wi 1997)**

Prerequisite

Mathematics H520, or H263 and 569, or permission of the instructor

Catalog Description

Introduction to convex sets in E^n, some point set topology in E^n, (including compactness and connectedness properties of subsets of E^n), differentiation of vector valued functions of several variables, relative extrema, the inverse and implicit function theorems, and an introduction to Lebesgue integration in E^n.

Purpose of Course

The sequence H540, H541 is meant to provide an introduction the geometry and/or topology of n-dimensional Euclidean space and manifolds in a context that makes it relevant to the students' other studies. The sequence is meant to be conducted in a mathematically rigorous manner and will therefore provide more exposure for the students to precise mathematical definitions and proofs.

Follow-up course

Math H541.

Text

Elements of Differential Geometry, R. Millman and G. Parker

(or similar level text)

For Further Information See:
V. Bergelson (Honors)
1997-98

Mathematics H541 **5 cr.** **Geometry and Calculus in Euclidean Spaces and on Manifolds II**
Sp*

*** OFFERED IN ODD YEARS ONLY (Sp 1993, Sp 1995, Sp 1997)**

Prerequisite

Mathematics 540, or permission of the instructor

Catalog Description

Review and completion of the discussion of Lebesgue integration in E^n, coverage of change of variables theorems in E^n, differentiation of parametrized integrals, curves in E^n, differential 1-forms, line integrals, the exterior algebra and differential calculus in E^n, differential forms and tensor algebra, integration on manifolds, the divergence theorem, and Stokes' theorem.

Purpose of Course

The sequence H540, H541 is meant to provide an introduction the geometry and/or topology of n-dimensional Euclidean space and manifolds in a context that makes it relevant to the students' other studies. The sequence is meant to be conducted in a mathematically rigorous manner and will therefore provide more exposure for the students to precise mathematical definitions and proofs.

Text

Elements of Differential Geometry, R. Millman and G. Parker

(or similar level text)

For Further Information See:
V. Bergelson (Honors)
1997-98

Mathematics 547 **3 cr.** **Introductory Analysis I**
A, W

Prerequisite:

Mathematics 345.

Catalog Description:

547, 548, 549 is an integrated sequence in advanced calculus covering sequences, limits, continuous functions, differentiation, Riemann integral; infinite series, sequences and series of functions, Taylor series, improper integrals.

Purpose of Course:

547, 548, 549 is a sequence designed to develop analytic intuition and proof skills. Student participation is emphasized. One of the primary purposes of 547 is that the student gain experience with concrete estimates.

Follow-up Course:

Math 548.

Text:

Bartle & Sherbert, Introduction to Real Analysis, used 92-93 through 95-96

Other possible texts:
K. G. Binmore, Mathematical Analysis, 2nd Edition
W. Fulks, Advanced Calculus

Topics:

1. Binomial coefficients and binomial formula. Sum of geometric progression. Polynomials-order of a zero and factorization.

2. Inequalities and operations with inequalities. Monotone functions, monotone sequences.

3. Boundedness. Finding an upper and a lower bound for a given sequence or for a rational function on an interval. Other types of elementary estimates.

4. Definition of the limit of a sequence. Limit rules. Standard examples of the limit.

5. Subsequences. The Bolzano-Weierstrass Theorem.

6. The Cauchy Criterion

Course Coordinator:
Bogdan Baishanski
1997-98

Mathematics 548 **3 cr.** **Introductory Analysis II**
Wi, Sp

<u>Prerequisite:</u>

Mathematics 547

<u>Catalog Description:</u>

Continuation of 547

<u>Purpose of Course:</u>

547, 548, 549 is a sequence designed to develop analytic intuition and proof skills. Student participation is emphasized.

<u>Follow-up Course:</u>

Math 549 or 551 or 552.

<u>Text:</u>

Bartle & Sherbert, <u>Introduction to Real Analysis</u>, used 92-93 through 95-96

Other possible texts:
K. G. Binmore, <u>Mathematical Analysis</u>, 2nd Edition
I. Hirschman, <u>Infinite Series</u>
W. Fulks, <u>Advanced Calculus</u>

<u>Topics:</u>

1. Limits of functions.

2. Continuous functions.

3. Definition of the derivative. Differentiation rules.

4. Mean Value Theorem and its consequences.

5. L'Hospital's Rules.

6. Taylor's Theorem.

Course Coordinator:
Bogdan Baishanski
1997-98

Mathematics 549 **3 cr.** **Introductory Analysis III**
Au,Sp

Prerequisite:

Mathematics 548.

Catalog Description:

Continuation of 548; the Riemann-Stieltjes integral; an introduction to the calculus of several variables.

Purpose of Course:

547, 548, 549 is a sequence designed to develop analytic intuition and proof skills. Student participation is emphasized. 549 is a continuation of 548. After completion of 548 the student is ready to begin the study of the calculus of several variables.

Text:

Bartle & Sherbert, Introduction to Real Analysis, used 92-93 through 95-96

Other possible texts:
K. G. Binmore, Mathematical Analysis, 2nd Edition
I. Hirschman, Infinite Series
W. Fulks, Advanced Calculus

Topics:

1. Definition of the Riemann integral. A piecewise continuous function is Riemann integrable (without proof). Properties of the integral.

2. Fundamental Theorem of Calculus. Integraton by parts and change of variable.

3. Exponential and logarithmic function.

4. Improper integrals.

5. Numerical series. Integral test. Comparison test.

6. Absolute convergence. Alternating series. Summation by parts.

7. Rearrangements. Double series.

8 Functional sequences and series.

9. Uniform convergence.

10. Power series.

Course Coordinator:
Bogdan Baishanski
1997-98

Mathematics 551 **5 cr.** **Vector Analysis**
Au, Sp

Prerequisite:

Mathematics 254

Catalog Description:

Vector operations in three dimensions, vector operators, surface area, the theorems of Green and Stokes, the divergence theorem; applications.

Purpose of Course:

The course is designed to enable students to understand and use the techniques of vector analysis in 2 and 3 dimensional spaces. Applications to the geometry of curves and surfaces will be emphasized. This course is not open to students with credit for 416 or 513.

Text:

Introduction to Vector Analysis, 6th Ed., H. Davis & A. Snider, used 1993-94 through 1995-96

or

Vector Analysis, Schaum's Outline Series and
Div, Curl, Grad & All That, Schey (these two were used together 1992-93)

Other References:
Advanced Calculus, 2nd ed., Wilfred Kaplan. (With supporting problems from Schaum's.)
Vector Calculus, 3rd Edition, T.E. Marsden and A. J. Tromba. (used 90-91)

Topics:

Vector operations in three dimensions, vector operators, line integrals, surface integrals, volume integrals. The theorems of Green, Gauss, and Stokes. Applications.

Course Coordinator:
Luis Casian
1997-98

Mathematics 552
Wi, Su

5 cr.

Introduction to the Theory of Functions of a Complex Variable

Prerequisite:

Mathematics 254

Catalog Description:

Topics discussed include power series expansions, the formula of Cauchy, residues, conformal mappings, and elementary functions in the complex domain.

Purpose of Course:

The students are to learn the basic facts and techniques of complex variables, as done in, for instance, the first eight or more chapters of Churchill and Brown. The fact that it is a 5 hour course permits more depth than is possible in 514 or 416. Because the course has minimal prerequisites, the emphasis will be on problem solving techniques. This course is not open to students with credit for 416 or 514.

Text:

Fundamentals of Complex Analysis, Saff & Snider, 2nd edition (used 92-93, 93-94 and 94-95)

or
Complex Variables and Applications, Churchill and Brown, or
Advanced Engineering Mathematics, Kreyszig, or
any one of a dozen others

Topics:

Algebra of complex numbers, geometry of the complex plane, elementary functions, conformal mappings, Taylor's and Laurent's series, residue calculus.

Course Coordinator:
Luis Casian
1997-98

Mathematics 556 **3 cr.** **Differential Equations I**
W

Prerequisite:

Mathematics 255, and prerequisite or concurrent 572.

Catalog Description:

Systems of linear, first-order differential equations, existence and uniqueness theorems, numerical methods, qualitative theory (phase plane analysis, linearization, stability, limit cycles),physical applications.

Purpose of Course:

To provide the student with the modern mathematical foundations of differential equations. Course Objectives: systems of linear, first-order differential equations, existence and uniqueness theorems, qualitative theory (phase plane analysis, linearization, stability, limit cycles).

Text:

Ordinary Differential Equations and Stability Theory: An Introduction, Sanchez

Topics and Sample Syllabus:

Linear Systems of Differential Equations	(4 weeks)
Existence and Uniqueness	(1 week)
Qualitative Analysis of Nonlinear Equations in the Plane	(5 weeks)

Grading: two midterms (100 pts. each), homework (100 points) and final exam (200 pts.).

Course Coordinator:
David Terman
1997-98

Mathematics 557 **3 cr.** **Differential Equations II**
Sp

Prerequisite:

Mathematics 556

Catalog Description:

Sturm - Liouville theory, partial differential equations in three or more variables, nonhomogeneous problems, Green's functions, and physical applications.

Purpose of Course:

An introduction to the basic properties of PDE's and to the techniques for analyzing them. Course Objectives: Basic properties of PDE's, wave equation, diffusion equation, Laplace's equation, Fourier series, and boundary value problems.

Possible Text:

Partial Differential Equations: An Introduction, W.A. Strauss, was used 1994.

Topics and Sample Syllabus:

Chapter 1 Where PDE's come from
1.1-1.4, 2 weeks

Chapter 2 Waves & Diffusion
2.1-2.5, 2 weeks

Chapter 4 Boundary Value Problems
4.1-4.3, 2 weeks

Chapter 5 Fourier Series
5.1-5.4, 2 weeks

Chapter 6 Harmonic Functions
6.1-6.3, 2 weeks

Possible grading: midterms (2 x 100 pts.), homework (100 points), final (200 pts.)

Course Coordinator:
David Terman
1997-98

Mathematics 560 **4 cr.** **Point-set Topology**
Sp

Prerequisite:

Mathematics 345.

Catalog Description:

Sets and functions, metric spaces, topological spaces, subspaces, limits, closure, interior, sequences, convergence, separation axioms, continuity, connectedness, compactness, product spaces, Euclidean spaces.

(See the Sample Syllabus below for a list of the topics that would actually be covered in the class.)

Purpose of Course:

Math 560 offers an introduction to topological concepts. Students are asked for elementary proofs, although prior experience with proofs is not expected.

Follow-up Course:

Before taking further Topology courses, a student will need Math 547-548. Math 560 has significant overlap with Math 640. Math 655, 656, 657 is the follow-up sequence for students who have had or take concurrently Math 651, 652, 653.

Text:

Undergraduate Topology, Kasriel, or

Topology, Eisenberg

(or an equivalent text approved by the Course Coordinator)

Sample Syllabus:

Preliminaries	1 1/3 weeks
Metric spaces	2/3 week
Open and closed sets	2/3 week
Convergence and continuity	2/3 week
Product spaces	1/3 week
Special properties including completeness, separable, second countable	2 weeks
Compactness	1 1/3 weeks
Connectedness	1 week
Homeomorphisms and topological properties	1 week
Quotient spaces (optional)	

There should be two midterms (worth 100 points each) and one final examination (worth 200 points). Homework is a very important part of this course and therefore should be worth 150 points.

Course Coordinator:
Yung-Chen Lu
1997-98

Mathematics 566 **3 cr.** **Discrete Mathematical Structures II**

A, W, Sp, Su (2nd Term)

Prerequisite:

Mathematics 366.

Catalog Description:

Algorithms, efficiency of algorithms; pigeonhole principle, combinatorial identities, inclusion-exclusion, generating functions; graphs, Euler tours, Hamiltonian cycles, isomorphism, planarity, colorings, algorithms on weighted graphs, networks.

Purpose of Course:

Follow-up to Math 366. The desire of the CIS faculty is that this course present math in rigorous form and require students to deal with abstract systems and mathematical proofs.

Text:

Discrete Mathematics and its Applications, Rosen, 3rd edition.

Topics:

Chapter 1 Logic, Sets and Functions

- 1.8 The Growth of Functions

Chapter 2 Algorithms, the Integers and Matrices

- 2.1 Algorithms
- 2.2 Complexity of Algorithms
- 2.3 The Integers and Division
- 2.4 Integers and Algorithms
- 2.5 Applications of Number Theory

Chapter 3 Mathematical Reasoning

- 3.4 Recursive Algorithms

Chapter 5 Advanced Counting Techniques

- 5.1 Recurrence Relations
- 5.2 Solving Recurrence Relations
- 5.4 Inclusion-Exclusion
- 5.5 Applications of Inclusion-Exclusion
- A.3 Generating Functions

Chapter 7 Graphs

- 7.1 Introduction to Graphs
- 7.2 Graph Terminology
- 7.3 Representing Graphs & Graph Isomorphism
- 7.4 Connectivity
- 7.5 Euler and Hamiltonian Paths
- 7.6 Shortest Path Problems
- 7.7 Planar Graphs
- 7.8 Graph Coloring

Chapter 8 Trees

- 8.1 Introduction to Trees
- 8.5 Spanning Trees
- 8.6 Minimal Spanning Trees

Course Coordinator:
Randall Dougherty
1997-98

Mathematics 568 **3 cr.** **Introductory Linear Algebra I**
A, W, Sp, Su (1st Term)

Prerequisite:

Mathematics 254. Not open to students with credit for 471, 571 or 577.

Catalog Description:

The space $\mathbb{R}^n$ and its subspaces; matrices as mappings; matrix algebra; systems of equations; determinants; dot product in $\mathbb{R}^n$; geometric interpretations.

Purpose of Course:

The purpose of the course is to provide an introduction to the concepts, vocabulary and results of matrix algebra with geometric interpretations in the space $\mathbb{R}^n$. Emphasis is on techniques, computational skills, and development as algebraic structure.

Follow-up Course:

Math 569.

Text:

Linear Algebra and its Applications, Lay, Addison-Wesley, 2nd ed.

Topics and Sample Syllabus:

Chapter 1 Linear Equations in Linear Algebra: systems (1.1); row reduction (1.2); vector equations (1.3); the matrix equation(1.4); solution sets of linear systems (1.5); linear independence (1.6)

Chapter 6 Orthogonality and Least-Squares: inner product, length, orthogonality (6.1); orthogonal sets(6.2); orthogonal projections(6.3); the gram-schmidt process (6.4)

Chapter 1 Linear Equations in Linear Algebra: introduction to linear tra~~m~~nsformations (1.7); the matrix of a linear transformation (1.8)

Chapter 2 Matrix Algebra: matrix operations (2.1); inverses (2.2); invertible matrices (2.3)

Chapter 4 Vector Spaces: subspaces (4.1); null spaces and column spaces (4.2); independence and basis (4.3); dimension (4.4); rank (4.5); change of basis (4.6)

Chapter 3 Determinants: properties of determinants (3.1-3.2); Cramer's rule (3.3)

Chapter 5 Eigenvalues and Eigenvectors: eigenvalues (5.1); characteristic equation (5.2); diagonalization (5.3); linear transformations (5.4)

Course Coordinator:
Ron Solomon
1997-98

Mathematics 569 **3 cr.** **Introductory Linear Algebra II**
A, W, Sp, Su (2nd Term)

Prerequisites:

Mathematics 568. Not open to students with credit for 572.

Catalog Description:

Vector spaces over $\mathbb{R}$ and $\mathbb{C}$; linear transformations; the polynomial ring $\mathbb{R}[x]$; characteristic values and vectors; inner product spaces; quadratic form reduction; principal axis theorem.

Purpose of Course:

The purpose of the course is to provide an introduction to vector spaces as an algebraic structure. Relying on the techniques and interpretations established in 568, more emphasis is placed here on abstraction and proof.

Text:

None required, using instructor's notes.

Topics:

1. Introduction to Vector Spaces and Inner Product Spaces.
2. Linear Transformations and their Matrices.
3. Systems of Equations.
4. Transformational View of Systems.
5. Basis and Dimension.
6. Eigenvalues and Eigenvectors.
7. Diagonalizability.
8. Applications to Discrete Dynamical Systems and to Systems of Differential Equations.
9. Real Inner Product Spaces.

Course Coordinator:
Ron Solomon
1997-98

Mathematics 571 **3 cr.** **Linear Algebra for Applications I**
A, Sp, Su (1st Term)

Prerequisite:

Math 254. Not open to students with credit for 569 or 601.

Catalog Description:

Linear systems of equations; vector spaces, matrices, linear operators; inner products, projections and least squares, approximations of eigenvalue problems. Applications.

Text:

1. Experiments in Computational Matrix Algebra, David R. Hill

2. Linear Algebra with Applications, S. Leon, 4th edition

Topics List:

The course combines theoretical linear algebra (Leon) with hands-on experience (Hill, and the software package Matlab). All classes are held in a MacIntosh Lab. Chapters 1-3 and the first half of each of chapters 4 and 5 will be covered from Leon, as well as chapters 1 and 2 of Hill. No programming is required for this course.

Leon:

Chapter 1-Matrices and Systems of Equations
Chapter 2-Determinants
Chapter 3-Vector Spaces
Chapter 5-Orthogonality (Sections 5.1 to 5.4)

Hill:

Chapter 1-Beginning to use MATLAB
Chapter 2-Linear Systems of Equations

Course Coordinator:
Ed Overman
1997-98

Mathematics 572 **3 cr.** **Linear Algebra for Applications II**
A, Sp, Su (2nd Term)

Prerequisite:

Math 571 or written permission of the department.

Catalog Description:

The eigenvalue problem for inner product spaces, projections and least squares approximation; classification of operators and quadratic forms; applications.

Text:

Linear Algebra with Applications, S. Leon, 4th edition

Topics List:

This is a continuation of 571. Chapters 4 and 5 of Leon's book will be completed, and Chapter 6 covered. There will be additional selected applications from Hill.

Leon:
- Chapter 4 - Linear Transformations
- Chapter 5 - Orthonormal Sets (Sections 5.5-end of chapter)
- Chapter 6 - Eigenvalues

Course Coordinator:
Ed Overman
1997-98

Mathematics 573 **5 cr.** **Elementary Number Theory**
Sp of odd numbered years

Prerequisite:

Mathematics 153

Catalog Description:

Utilization of concrete examples to introduce concepts of modern algebra; prime numbers, congruences, Diophantine equations, elementary combinatorial analysis.

Purpose of Course:

To introduce students to concepts in elementary number theory which serve as important examples of more general notions in modern abstract algebra; to develop reasonable facility in proofs involving these concepts.

Text:

An Introduction to the Theory of Numbers, 3rd edition, Niven and Zuckerman (or equivalent)

Topics:

1. Divisibility properties of $\mathbb{Z}$; primes, Euclidean algorithm, unique factorization, greatest common divisors, least common multiples.

2. Linear Diophantine equations.

3. Congruences; Euler's function, Euler-Fermat Theorem, primitive roots.

4. Linear congruences, Chinese Remainder Theorem, quadratic congruences, Quadratic Reciprocity Law.

5. Optional Topics: Pythagorean Triples, sums of squares, cryptography, higher degree Diophantine equations.

Course Coordinator:
Paul Ponomarev
1997-98

Mathematics 574 **5 cr.** **Geometry**
Sp of even numbered years

Prerequisite:

Mathematics 568.

Catalog Description:

Euclidean and non-Euclidean geometry, emphasizing algebraic connection; Affine and projective planes, duality. Topics from: geometry of groups; finite planes, Hilbert's postulates, n-dimensional spaces.

(NOTE: The "Topics from" part of the catalog description is misleading. See below for the emphasis of the course.)

Purpose of Course:

To strengthen geometric intuition, stress geometric aspects of linear algebra, and to introduce the student to geometries different from high school geometry. Kaplansky's little book, Linear Algebra and Geometry; A Second Course, conveys the ideal spirit one should try to achieve.

Topics:

Construction of the real projective plane from the affine plane, barycentric and homogeneous coordinates, duality, affine and projective transformations, double ratio. Conic sections, and the group of a conic section. Exercises on projective planes over $\mathbb{Z}$ mod p.

Course Coordinator:
Joe Ferrar
1997-98

Mathematics 575 **5 cr.** **Combinatorial Mathematics and Graph Theory**
Wi, Sp

Prerequisite:

Mathematics 568.

Catalog Description:

Matching theory, graph theory, network flows, and optimization; enumeration techniques; combinatorial designs and coding theory.

Purpose of Course:

The purpose of this course is to acquaint the student with some aspects and applications of modern combinatorial theory; in particular, to communicate the meaning of the word "combinatorial" and to develop the student's facility for dealing with discrete and essentially non-algebraic mathematical problems. The primary emphasis is on theory, but numerous illustrations and applications are presented. In addition, much of the theory (e.g., network flow theory, matching theory) has developed in response to practical optimization problems of various kinds.

The course is designed to serve both the prospective mathematics graduate student as well as the student with an interest in or need for combinatorial techniques and tools.

Text:

Combinatorics: An Invitation, Straight

Topics List:

1. Basic counting principles: sets, mappings, one-to-one correspondences and cardinality, the rules of sum and product, pigeonhole principle, binomial coefficients.

2. Enumeration theory: inclusion - exclusion principle, recurrence relations, generating functions.

3. Elementary graph theory: paths, connectivity, Eulerian and Hamiltonian graphs, matchings in bipartite graphs, planar graphs, graph colorings.

4. Combinatorial designs: Latin squares, finite geometries, block designs, difference sets.

Course Coordinator:
Tom Dowling
1997-98

Mathematics 578 **5 cr.** **Discrete Mathematical Models**
Au, Sp

Prerequisite:

CIS 221, and Mathematics 568, and either Mathematics 530 or Statistics 425.

Catalog Description:

Analysis and solution of various applied problems using discrete mathematical models; methods used include theory of eigenvectors and eigenvalues from linear algebra, graph theory, linear optimization, Markov chains and queues.

Purpose of Course:

1. To introduce the mathematical structures and develop the mathematics appropriate for discrete modeling.
2. To demonstrate and encourage use of computers in solving mathematical problems
3. To give students an experience with a real world application for which they can construct a model that can be used to explore possible solutions.
4. To apply mathematical concepts and techniques encountered in earlier courses in the context of discrete modeling in a way that brings a new vividness and interest to the ideas.

Text:

Discrete Dynamical Systems, Sandefur

Other References:

Mathematical Modeling, Maki & Thompson

Applying Mathematics, Burghes, Huntly & McDonald

Computer Simulation, Nancy Roberts et al, Addison-Wesley

Applications of Linear Algebra, Anton and Rorres, Wiley

An Introduction to Mathematical Models, Olinick

A variety of different modules available through COMAP

Topics:

This course can examine a number of different topics in which the tools of discrete mathematics are used in the development of mathematical models. Among the topics could be:

1. Discrete deterministic models developed from numerical data.
2. Markov processes
3. Random processes and Monte Carlo simulation.
4. Linear optimization and the simplex algorithm.
5. Graph theory, including shortest paths, minimum weight spanning trees, and job scheduling.
6. Network flows and the Ford-Fulkerson algorithm for maximum flow.
7. Additional modeling topics as time and the interests of the instructor permit.

As a pedagogical tool, assignment of a term project involving discrete modeling with class reports the last week of the quarter, is highly recommended.

Course Coordinator:
D. Ray-Chaudhuri
1997-98

Mathematics 580 **3 cr. each** **Algebra I**
A, W

Prerequisite:

Mathematics 568 (may be taken concurrently with 580) and Mathematics 345.

Catalog Description:

The integrated algebra sequence 580, 581, 582 includes elementary number theory, group theory, vector spaces and linear transformations, field theory.

Purpose of Course:

The 580-581-582 sequence covers topics in the theory of polynomial equations, number theory, geometry, linear algebra, and algebraic structures in a unified and integrated way.

The principal goal of the sequence is to show how abstract algebraic structures and methods deepen and enrich our understanding of the basic structures and concepts of school mathematics-numbers and arithmetic, polynomial equations, congruence and symmetry, ruler and compass constructions.

Text:

Notes by R. Solomon

Follow-Up Course:

Math 581

Topics:

Theory of equations, elementary number theory, elementary properties of groups, Lagrange's Theorem.

Course Coordinator:
Ron Solomon
1997-98

Mathematics 581 **3 cr. each** **Algebra II**
W, Sp

Prerequisite:

Mathematics 580

Catalog Description:

Continuation of 580.

Purpose of Course:

The 580-581-582 sequence covers topics in the theory of polynomial equations, number theory, geometry, linear algebra, and algebraic structures in a unified and integrated way.

The principal goal of the sequence is to show how abstract algebraic structures and methods deepen and enrich our understanding of the basic structures and concepts of school mathematics-numbers and arithmetic, polynomial equations, congruence and symmetry, ruler and compass constructions.

Text:

Notes by R. Solomon

Follow-Up Course:

Math 582

Topics:

More elementary number theory, theory of equations, elementary properties of rings, 2-dimensional groups of motions, ruler and compass constructions

Course Coordinator:
Ron Solomon
1997-98

Mathematics 582 **3 cr. each** **Algebra III**
Sp, A

Prerequisite:

Mathematics 581

Catalog Description:

Continuation of 581.

Purpose of Course:

The 580-581-582 sequence covers topics in the theory of polynomial equations, number theory, geometry, linear algebra, and algebraic structures in a unified and integrated way.

The principal goal of the sequence is to show how abstract algebraic structures and methods deepen and enrich our understanding of the basic structures and concepts of school mathematics- numbers and arithmetic, polynomial equations, congruence and symmetry, ruler and compass constructions.

Text:

Notes by Ron Solomon

Topics:

Three-dimensional groups of motions. Some linear algebra. Elements of Galois theory.

Course Coordinator:
Ron Solomon
1997-98

Mathematics H590 Au 5 cr. Algebraic Structures I
H591 Wi 3 cr. Algebraic Structures II
H592 Sp 3 cr. Algebraic Structures III

Prerequisite:

H590--- H520 with a grade of C or better, or written permission of Honors Committee Chairman.

H591--- H590 with a grade of C or better or written permission of Honors Committee Chairman.

H592--- H591 with a grade of C or better or written permission of Honors Committee Chairman.

Catalog Description For H590:

Integers, congruence relations, structure preserving maps, topics from groups, rings, modules, vector spaces, fields. The sequence H590, H591, H592 substitutes for the sequence 580,581,582.

Text:

Abstract Algebra, Dummit (used 92-93, 93-94, 94-95)
or
Topics in Algebra, Herstein (used 1995-96)

Suggested Topics List

H590:

1. Integers, unique factorization; congruences, Euler function.
2. Groups, subgroups, homomorphisms and isomorphisms, normal subgroups, quotient groups, permutation groups, cyclic groups, Cauchy Theorems, Sylow's Theorems; direct products, fundamental theorem for finite Abelian group; G-sets.
3. Rings, subrings, ideals, morphisms, polynomial rings, prime and maximal ideals.

H591:

1. Commutative rings, factorization theory, Euclidean rings, principal ideal rings, unique factorization domains, Gauss' lemma; illustrations in the integers of quadratic number fields.
2. Modules over commutative rings, submodules, quotients and direct sums; fundamental theorem for modules over principal ideal domains.
3. Vector spaces (as a special case of modules); linear maps and matrices, canonical forms, dual spaces.
4. The theory of determinants.

H592:

1. Bilinear and quadratic forms; inner product and unitary spaces; principal axis theorem.
2. Fields, algebraic and transcendental (extensions), existence of closure (over countable fields), tests for polynomial irreducibility; normality, separability, field automorphisms.
3. Galois theory, the subgroup-subfield correspondence theorem, group theory interrelations; extensions of finite fields, cyclotomic extensions.
4. Solvable groups and solvability by radicals.

For Further Information See:
V. Bergelson (Honors)
1997-98

Mathematics 616 **4 cr.** **Numerical Methods in Actuarial Mathematics**
Au (2 2-hour classes)

Prerequisite:

Mathematics 254, and either 471 or 569; or permission of instructor.

Catalog Description:

Finite differences, difference operators, interpolation, summation, difference equations; applications to actuarial science and finance.

Purpose of Course:

This course is designed to provide students with an introduction to the mathematical topics in numerical analysis which are relevant to actuarial science. The course includes the material on numerical methods in the Associateship Examination of the Society of Actuaries and the Casualty Actuarial Society. The course is required for the undergraduate major in actuarial science.

Text:

Numerical Analysis., Burden, R. L., Faires, J. D., 5th edition, 1989, PWS Publishers.

Topics:

The minimum course content is:

1. Solution of Equations in One Variable
2. Interpolation and Polynomial Approximation
3. Numerical Integration
4. Direct Methods for Solving Linear Systems

For further information see:
Bostwick Wyman
1997-98

Mathematics 618 **3 cr.** **Theory of Interest**
Wi (Two 1 1/4-hour classes)

Prerequisite:

Mathematics 254, or permission of instructor.

Catalog Description:

Mathematical techniques of use in analyzing financial transactions involving interest: measurement of interest, force of interest, annuities-certain, applications to actuarial sciences.

Purpose of Course:

This course is the first with any specific actuarial content. Undecided students looking to actuarial science as a possible course of study or profession may find this course to be a valuable indicator of their aptitude and interest. This course includes the material on the mathematics of compound interest in the associateship examinations of the various actuarial organizations. The course is required for the undergraduate major in actuarial science.

Text:

The Theory of Interest, 2nd edition, S. G. Kellison.

Topics:

The minimum course content is:

1. Measurement of interest and discount, compound interest.
2. Force of interest, equations of value.
3. Annuities-certain, continuous annuities, varying annuities.
4. Amortization, numerical calculation of yield rates.
5. Valuation of securities.
6. Measurement of interest on a fund, life insurance settlement options, installment loans.
7. Depreciation, depletion, capitalized cost.

For further information see:
Bostwick Wyman
1997-98

Mathematics 630 **3 cr.** **Mathematics of Life Contingencies I**
631 **Mathematics of Life Contingencies II**
632 **Mathematics of Life Contingencies III**

Au: 630 (Two 1 1/4 hour classes)
Wi: 631 (Two 1 1/4 hour classes)
Sp: 632 (Two 1 1/4-hour classes)

Prerequisite:

Mathematics 618, and Statistics 520 or equivalent; or permission of instructor.

Catalog Description:

630: Individual risk models; survival distributions and life tables; life insurance annuities

631: Continuation of 630; net premiums and net premium reserves; multiple life functions; multiple decrement models.

632: Continuation of 631; valuation theory for pension plans; insurance models including expenses; nonforfeiture benefits and dividends; topics of interest in life and casualty contingencies.

Purpose of Courses:

This sequence is designed to introduce students to the mathematical content of the theory of contingencies. The sequence includes the material on life contingencies in the Associateship Examination 150 of the Society of Actuaries. The sequence is required for the undergraduate major in actuarial science.

Text:

Actuarial Mathematics., Newton L. Bowers, Jr., et al, Society of Actuaries, 1986.

The following are useful references:

Life Contingencies, C. W. Jordan
Mortality Table Construction, R. W. Batten

(Over for Topics)

Topics List

Minimum Course Content:

630
1. Survival Distributions and Life Tables
2. Life Insurance and Life Annuities
3. Net Premiums

631
4. Net Premium Reserves
5. Multiple Life Functions
6. Multiple Decrement Models
7. Valuation Theory for Pension Plans

632
8. Insurance Models including Expenses
9. Nonforfeiture Benefits and Dividends

Special Note:

The minimum course content should be completed by May 1 for the benefit of students preparing for the May actuarial examinations.

For further information see:
Bostwick Wyman
1997-98

Mathematics 650 **5 cr.** **Principles of Mathematical Analysis**
Su

Prerequisite:

Mathematics 547 or permission of the Graduate Advising Comm.

Catalog Description:

Riemann-Stieltjes Integral; Uniform Convergence and Interchange of Limit Processes, Special Functions, Fourier Series.

Purpose of Course:

New graduate students in Statistics and Mathematics will form the core of the audience. This group will be supplemented by students from various disciplines. These students need more maturity in mathematical analysis for their graduate work. The plan of the course is to work on topics close to application in statistics, and to use feedback from student discussion, board presentations, and exercise sets to determine what advanced calculus material needs special review.

Text: Principles of Mathematical Analysis, (3rd.), by Walter Rudin, McGraw-Hill.

Topics:

Week 1: Completeness, countability, Cantor set, introduction to the Riemann-Stieltjes integral.

Week 2: Existence and properties of the Riemann-Stieltjes integral.

Week 3: Integration of vector-valued functions, rectifiable curves. Examples illustrating difficulties in interchange of limit processes; uniform convergence. Test 1.

Week 4: Uniform convergence of sequences of complex valued functions, as related to continuity, integration and differentiation.

Week 5: Discussion of exercises; review of advanced calculus topics, especially continuity. Test 2.

Week 6: Power series: analytic properties, radius of convergence, including review of less advanced topics.

Week 7: Exponential, logarithmic and trigonometric functions; the gamma function.

Week 8: Complex Fourier series.

Week 9: Discussion of exercises.

Week 10: Review and final examination.

The students' grades will be based on the two tests (20% each), the final examination (40%), exercise sets (20%).

For Further Information See:
B. Baishanski
1997-98

Mathematics	**651**	**Au**	**5 cr. each**	**Introduction to Real Analysis I**
	652	**Wi**		**Introduction to Real Analysis II**
	653	**Sp**		**Introduction to Real Analysis III**

Prerequisite:

Permission of Department.

Catalog Description:

651: Real numbers, infinite sequences and series.

652: Continuous functions, differentiable functions and functions of bounded variation; Riemann-Stieltjes integral.

653: Measurable sets and functions, elementary theory of the Lebesgue integral.

Purpose of Course:

Basic analysis course for mathematics M.S. students, Mathematics Ph.D. students with incomplete prerequisites, and a few others. General work on writing proofs, and on analytic intuition. These courses are the preparation for the Qualifying Exam in Analysis.

Follow-up Courses:

Math 722: Theory of Probability I
Math 750: Real Analysis I
Math 767: Introduction to the Theory of Approximation I

Possible Text:

R. Strichartz, The Way of Analysis (used 1995-96); supplementary material may be required

or:
K. Stromberg, An Introduction to Classical Real Analysis (used 94-95 and 96-97)
651: Chapters 2 and 3; 652: Chapters 4, 5 and 7 (except optional sections); 653: Chapter 6

or:
W. Rudin, Principles of Mathematical Analysis and H. Royden, Real Analysis
651: Rudin, Chapters 1-5; 652: Rudin, Chapters 6-8;
653: Rudin, Chapter 9, and Royden, parts of Chapters 3, 4, 11 and 12

or:
K. Hoffman, Analysis in Euclidean Space
651: Chapters 2 and 3; 652: Chapters 4 and 5 (and possibly 6); 653: Chapters 7 and 8

or: equivalent text chosen by the instructor--If another text is chosen, be sure to cover the Qualifying Exam syllabus.

For Further Information see:
Paul Nevai
1997-98

Mathematics 655 Au **4 cr. each** **Elementary Topology I**
656 Wi **Elementary Topology II**
657 Sp **Elementary Topology III**

Prerequisite:

Permission of Department. Reasonable undergraduate background in calculus in Euclidean spaces - for example H540/H541 and/or an undergraduate course in topology or differential geometry, eg. 560. Some background in linear algebra (eg. 568) is desirable. For 656 and 657 an introductory course in undergraduate algebra along the lines of 580 is required (may be taken concurrently).

Catalog Descriptions (as currently appearing in University Bulletin):

655:
Continuity, compactness, connectedness in metric and general topological spaces, completeness in metric spaces.

656:
Continuation of 655; products, quotients, separation axioms, convergence, metrization and compactifications for general topological spaces.

657:
Continuation of 656; fundamental group and covering spaces.

(NOTE: The catalog description is obsolete. See below.)

Purpose of Course:

The 655-656-657 sequence is an introduction to topology for beginning graduate students and advanced undergraduates. 655 is a quick introduction to basic concepts of point set topology: compactness, connectedness, quotient spaces, manifolds (particularly surfaces). 656 is devoted to the fundamental group and covering spaces, while 657 is an introduction to homology theory.

Follow-up Courses:

Math 860-861-862 for algebraic topology; Math 866-867-868 for differential topology

Possible Texts:

Basic Topology, by M. A. Armstrong, Springer-Verlag, 1994.

A Basic Course in Algebraic Topology, by W. S. Massey, Springer-Verlag, 1991.

Elements of Algebraic Topology, by J. R. Munkres, Addison-Wesley, 1993.

Algebraic Topology: A First Course, by M. J. Greenberg & J. R. Harper, Addison-Wesley, 1982.

Depending on the background of the students and how much point set topology you want to cover, you might supplement Armstrong with:

Topology: A First Course, by J. R. Munkres, Prentice-Hall, 1975.

(see next page for topics)

Topics:

Metric and topological spaces and continuity
Connectedness and path-connectedness
Compactness
Quotient spaces
Topological manifolds
Classification of closed surfaces
The fundamental group
Seifert-Van Kampen theorem
Covering spaces
Simplicial complexes
Homology groups
Mayer-Vietoris sequence and excision
Brouwer fixed point theorem, degree of a map
Jordan-Brouwer separation theorem
Euler characteristic

Possible Additional Topics:

Metrization theorems
Space-filling curves
Branched covers
Knots and knot groups
Fundamental theorem of algebra & extensions to quaternions & octonions
Borsuk-Ulam theorem
Lefschetz fixed point theorem

Course Coordinator:
Zbigniew Fiedorowicz
1997-98

Mathematics 670 Au 5 cr. Algebra I
671 Wi Algebra II
672 Sp Algebra III

Prerequisite:

Permission of Department. Reasonable undergraduate algebra background - for example, 568, 580, 581, 582. At least one year (including linear algebra) strongly recommended.

Catalog Descriptions (as currently appearing in University Bulletin):

670:
Elementary theory of groups, permutation groups, Polya theory of counting, rings and ideals, polynomials.

671:
Continuation of 670: vector spaces, linear transformations, canonical forms for matrices, linear programming, orthogonality.

672:
Continuation of 671: quadratic forms, finite fields, various applications.

(NOTE: These descriptions are not always accurate in reflecting the current content of the courses. The content does vary year-to-year depending on the instructor and text. See other side for one sample syllabus.)

Purpose of Course:

Standard entry course for M.S. students in mathematics. Should supply much of the material needed for the Qualifying Examination in Algebra.

Text:

Abstract Algebra, Dummit & Foote (used starting in 670, Au 95)

or

Algebra, Artin (used 1992-93, 1993-94, and 1994-95)

or

Topics in Algebra, Herstein.

(Over For Sample Syllabus)

Sample Syllabus:

670: 1) Elementary Number Theory: gcd, congruence, Euler-Fermat theorem (3 weeks)

2) Basic Linear Algebra: vector spaces (especially finite-dimensional and function spaces), bases, change of basis; linear operators and their matrices, rank and nullity, determinants, eigenvalues and eigenvectors, minimal and characteristic polynomials and the Cayley-Hamilton Theorem; simultaneous diagonalization (5 weeks)

3) Basic Group Theory: elementary concepts: element order, cyclic groups, Lagrange's Theorem (2 weeks)

671: 1) Statement and proof of structure theorem on finitely generated abelian groups. (3 weeks)

2) Group Theory with emphasis on groups acting on sets, Sylow theorems (2 weeks)

3) Statement and proof of rational and Jordan canonical form. (3 weeks)

4) Basic Bilinear Algebra: Bilinear and hermitian forms, inner product spaces, Gram-Schmidt, orthogonal decompositions and projections (2 weeks)

672: 1) Basic commutative ring theory: rings (with 1), homomorphisms, ideals, principal ideals, prime and maximal ideals, quotient rings. PID's, UFD's. Ideals and quotients of k[x]. (4 weeks)

2) Galois Theory: Finite extensions of $\mathbb{Q}$, basic Galois correspondence. Finite fields. Solvability by radicals. Straight-edge and compass constructions. (6 weeks)

This sample syllabus was based on the Artin text, as used 1993-94. The content of the sequence will vary depending on the text and instructor.

For Further Information See:
Joe Ferrar
1997-98

Mathematics 694 **3 cr.** **Group Studies: Differential Equations for Engineering Applications**
SP 99

Prerequisite:

Permission of Instructor.

Catalog Description:

Designed to give groups of students an opportunity to pursue special studies not otherwise offered.

Purpose of Course:

This course is intended to introduce students to the basic methods for solving ordinary and partial differential equations, and to present some applications. This course will be coordinated with the course Aero-Eng 694, taught by the Dept.of Aerospace Engineering, Applied Mechanics, and Aviation, where students will be introduced to the physical concepts of conduction heat transfer and vibrations with applications primarily in aerospace engineering. Our goal is that the student will have a greater appreciation of the mathematical techniques being taught as well as developing skills to solve specific heat conduction and vibration problems that arise in engineering applications.

Texts:

Elementary Differential Equations and Boundary Value Problems, 6th edition, Boyce and DiPrima.

Topics:

1.1, 2.5, 2.7	Introduction to Differential Equations and some Applications: Cooling, Compound Interest, Mixing, and/or Mechanics.
2.1, 2.2:	Linear First Order ODE's and Integrating Factors
2.5	Applications from Lecture 1 revisited
2.7, 2.3:	Applications: Mechanics: Separable Equations
2.3, 2.4 2.2:	Differences Between Linear and Nonlinear Equations, Bernoulli's Equation
2.8:	Exact equations
2.6:	Qualitative Properties of solutions--Equilibrium solutions, Stability, sketch of solutions, apply to chemical kinetics
3.8, 3.1:	Vibrations , Define Linear Homogeneous and Inhomogeneous Equations, Principle of Superposition of Solutions for Homogeneous Linear Equations, Constant Coefficient Equations with Distinct Roots of the Characteristic Polynomial
3.2, 3.3:	Fundamental Solutions, Linear Independence, Wronskian
3.4, 3.5:	Review Properties of Complex Numbers (Handout), Complex Roots, and Repeated Roots of the Characteristic Equation
5.5:	Euler's Equation
3.6:	Nonhomogeneous Equations: Method of Undetermined Coefficients
3.7:	Nonhomogeneous Equations: Variation of Parameters
5.1:	Review of Power Series
5.2:	Examples of Series Solutions near an Ordinary Point
5.4, 5.6-5.8:	Regular Singular Points, Frobenius Method, Bessel's Equation
10.2-10.4:	Fourier Series, Convergence of Fourier Series, Even and Odd Functions
6.1-6.3,6.6:	Laplace Transform, Solution of Ordinary Differential Equations, Shifting Theorems, Convolution
10.6:	The Wave Equation--Derivation, Solution and Applications

For More Information See:
George Majda
1997-98