Department of Mathematics
The Ohio State University

1998-1999 Mathematics Courses

Course Number	Course Title
50	Pre-College Mathematics I
75	Pre-College Mathematics II
76	Reentry Precollege Math
103	Enrichment of Basic College Mathematics
104	Basic College Mathematics
105	Mathematics for Elementary Teachers I
106	Mathematics for Elementary Teachers II
107	Topics in Mathematics for Elementary Teachers
116	Excursions in Mathematics
117	Survey of Calculus
130	Math Analysis for Business I
131	Mathematical Analysis for Business II
132	Mathematical Analysis for Business III
148	Algebra and Trigonometry and Their Applications
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

Course Number	Course Title
264H	Elementary Analysis III
140	Special Calculus Options 1998-1999
141	Special Calculus Options 1998-1999
255	Differential Equations and Their Applications
345	Foundations of Higher Mathematics
366	Discrete Mathematical Structures I
415	Ordinary and Partial Differential Equations
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

Course Number	Course Title
574	Geometry
575	Combinatorial Mathematics & Graph Theory
578	Discrete Mathematical Models
580	Algebra I
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
694D	Group Studies: Differential Equations for Engineering Applications

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

THE OHIO STATE UNIVERSITY

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.

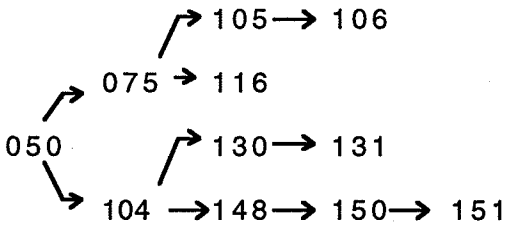
Purpose of Course:

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

THE OHIO STATE UNIVERSITY

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
1998-99

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

THE OHIO STATE UNIVERSITY

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:

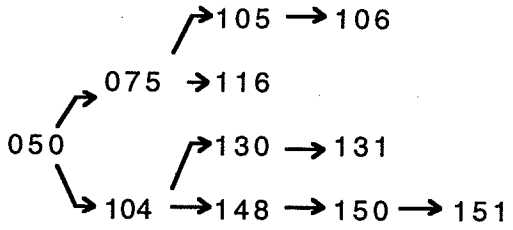
To meet the needs of students entering the University with Course Code S on Math Placement Test, or with credit for 050. In addition, **students placing at Course Code R** and who need Math 130, must take **104** prior to enrolling in 130. Completion of Math 075 is required for entry into numerous degree 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:

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

(Over for Topics & Sample Syllabus)

Topics List & Sample Syllabus

THE OHIO STATE UNIVERSITY

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

Course Coordinator:
Brian McEnnis
1998-99

INNOVATIVE STUDIES 1998-1999

1) Math 050A, 075A

These courses are not offered this year.

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
1998-99

THE OHIO STATE UNIVERSITY

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.

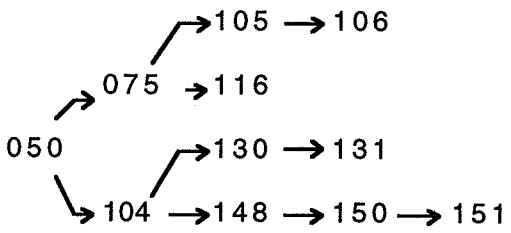
Purpose of Course:

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, and 116. 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:



THE OHIO STATE UNIVERSITY

Text:

Algebra, An Approach for Success, 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

THE OHIO STATE UNIVERSITY

Course Coordinator:
Gloria Woods
1998-99

Mathematics 103 **2 cr.** **Enrichment of Basic**
Au, Wi **College Mathematics**

Catalog Description:

Supplement to Math 104 using small group interaction and active learning to enhance the development of skills necessary to succeed in 104 subsequent courses.

This course ran under the 194A course number from Au 94 to Au 97.

Prerequisite:

New first quarter freshman, no math admission condition, and Math Placement T or S; concur 104.

Purpose of Course:

This course offers a supplement for Course Code T and S students using interactive learning. Enrollment in 103 enables these students to concurrently enroll in Math 104, instead of 050. Math 103 was offered in Au 94, Au 95, Au 96, and Au 97 under the Math 194A course number.

Follow-up course:

Students in 103 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.

Course Coordinator:
Harry Allen
1998-99

THE OHIO STATE UNIVERSITY

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

Prerequisite:

Mathematics 050, or 075, or Course Code R or satisfactory score 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:

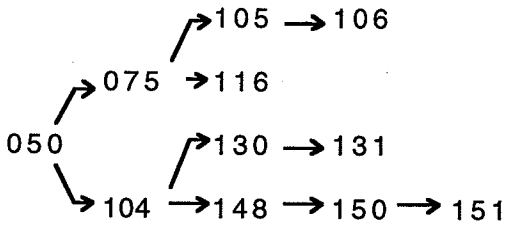
To meet the needs of students entering the University with Course Code R or with credit for 050 who need to complete Math 130 or 148. Completion of Math 104 is required for entry into some degree granting colleges.

Follow-up Course:

Math 130 or 148.

THE OHIO STATE UNIVERSITY

Sequencing Chart:



Text:

Essentials of Intermediate Algebra-Graphs and Functions, 2nd edition-OSU Version, Larson, Hostetler, and Neptune.

First used Autumn 1998, replacing the Johnson and Steffensen text.

(Over for Topics and Sample Syllabus)

Topics List & Sample Syllabus

Sections	Topics
1.3-1.8;OSU.2	Algebraic Expressions Operations with Polynomials Factoring Polynomials Factoring Trinomials Solving Linear Equations Solving Equations by Factoring Additional Exercises in Literal Equations
2.2,2.4,2.5	Graphs of Equations Relations and Functions Functional Notation Graphs of Functions
	Review and 1st Midterm
2.3,3.1,3.3-3.5	Slope: An Aid to Graphing Lines Writing Equations of Lines Applications of Linear Equations Business and Scientific Problems Linear Inequalities in One Variable
4.1,5.1,5.2	Systems of Linear Equations in Two Variables Integer Exponents and Scientific Notation Rational Exponents and Radicals
	Review and 2nd Midterm
5.3-5.5,6.1-6.5	Simplifying and Combining Radicals Multiplying and Dividing Radicals Solving Radical Equations The Factoring and Square Root Methods Completing the Square The Quadratic Formula and the Discriminant Applications of the Quadratic Equations Graphing Quadratic Functions
	Review and 3rd Midterm
7.1-7.3;7.5;OSU.1	Simplifying Rational Expressions Multiplying and Dividing Rational Expressions Addition and Subtraction of Rational Expressions Solving Rational Equations Applications of Rational Equations

THE OHIO STATE UNIVERSITY

Course Coordinator:
Paul Ponomarev
1998-99

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

Prerequisite:

Mathematics 075 or 104, or Course Code L, M, N or R on Math Placement Test. 105N open only to Rank 4 and GRD EDU students, and to students who've applied to GRD EDU.

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

THE OHIO STATE UNIVERSITY

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
1998-99

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

Prerequisite:

Mathematics 105 or written permission of the department. 106N open only to Rank 4 and GRD EDU students, and to students who've applied to GRD EDU.

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

THE OHIO STATE UNIVERSITY

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
1998-99

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

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.

THE OHIO STATE
UNIVERSITY

Course Coordinator:
Joe Ferrar
1998-99

Mathematics 116 **5 cr.** **Excursions in Mathematics**
A, W, Sp, Su

Prerequisite:

Mathematics 075 or 076 or 104 or satisfactory score on Math Placement Test.

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.

Follow-up Courses:

None. Math 116 is a terminal course.

THE OHIO STATE UNIVERSITY

Text:

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

Topics list

Section	Topics
1.1	Statements and Logical Connectives
1.2	Deduction
1.3	Categorical Symbolism
1.4	Problem Solving
2.5	Solving Percent Problems
2.6	Integer Exponents
2.7	General Exponents
3.1	Organizing and Picturing Data
3.2	Comparisons
3.3	Enhancement, Distraction, and Distortion
3.4	Means, Medians, and Percentiles
4.1	Normal Distributions
4.3	Confidence Intervals and Reliable Estimation
5.1	Computing Probabilities in Simple Experiments
5.3	Conditional Probability, Independence, and Expected Value
6.1	Interest
6.2	Loans
6.3	Amortized Loans
6.4	Buying a House
6.5	Annuities and Sinking Funds
8.1	Linear Constraints
8.2	Linear Programming

Course Coordinator:
Tom Dowling
1998-99

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

Prerequisite:

Mathematics 130 or 148 or 150

THE OHIO STATE UNIVERSITY

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, this course 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
11.4	Continuity
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
13.5	Higher Order Derivatives
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

THE OHIO STATE UNIVERSITY

Course Coordinator:
Surinder Sehgal
1998-99

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

Prerequisite:

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

Catalog Description:

Equations, inequalities, absolute value, polynomial functions, exponential and logarithmic functions, 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

THE OHIO STATE UNIVERSITY

Text:

Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Haeussler & Paul, 9th 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)
Linear Inequalities in Two Variables	(7.1)

Course Coordinator
Gloria Woods
1998-99

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

NOTE: The textbook for Wi 99 will be Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Hauessler/Paul, 9th ed.

Prerequisite:

Mathematics 130 or 148 or 150, or Course Code L on Math Placement Test.

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:

Au 98

Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Haeussler & Paul, 8th ed. and supplement: 9th edition Appendix A.

Wi 99, Sp99, Su99

Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Haeussler & Paul, 9th 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)
Review: Equations and Slope of Line	(4.2)(A.1)
Linear Inequalities in Two Variables	(7.1)
Linear Programming	(7.2)
Multiple Optimum Solutions	(7.3)
Secant Lines, Average Rate	(A.2)
Slope of a Curve	(A.3)
Area	(A.4)
Summation	(A.5)
Riemann Sum, Definite Integral	(A.6)
Area Under a Rate-of-Change Curve	(A.7)

THE OHIO STATE UNIVERSITY

Course Coordinator
Phil Huneke
1998-99

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

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.

Purpose of Course:

The 131 and 132 courses are designed to introduce students in the College of Business to topics in finite mathematics, modeling, and an overview of differential and integral calculus. The courses are problem oriented with emphasis on business applications

Text:

Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, 8th edition, by Ernest Haussler/Richard S. Paul, Chapters 11-17.

This course will use the 9th Ed. of Haussler/Paul beginning Sp 99.

Topics:

Limits	11.1, 11.2
Continuity Applied to Inequalities	11.5
Derivatives	12.1
Rules of Differentiation	12.2
The Derivative as a rate of Change	12.3
Product, Quotient Rules	12.5
Power Rule	12.6
Derivatives of Logarithmic Functions	13.1
Derivatives of Exponential Functions	13.2
Higher Order Derivatives	13.5
Relative Extrema	14.1
Absolute Extrema on a closed Interval	14.2
Curve Sketching	14.3
Second Derivative Test	14.4
Applied Maxima and Minima	15.1
The Indefinite Integral	16.1
Integration with Initial Conditions	16.2
More Integration Formulas	16.3
Techniques of Integration	16.4
The Fundamental Theorem of Calculus	16.7
Area	16.8
Area Between Curves	16.9
Consumer Surplus and Producers Surplus	16.10
Integration by Tables	17.3
Approximate Integration	17.5

THE OHIO STATE UNIVERSITY

Course Coordinator
Surinder Sehgal
1998-99

Mathematics 148 **4 cr.** **Algebra and Trigonometry**
A, W, Sp, Su **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

Text:

College Algebra and Trigonometry by Dwyer & Gruenwald

Technology: All students are required to have a graphing calculator

Topics

Integer Exponents	(1.4)
Radicals and Rational Exponents	(1.8)
Rational Expressions	(1.7)
Rational and Radical Equations and Inequalities	(2.6)
Modeling with Functions and Variation	(4.5)
Linear Relations	(3.3)
Solving Systems of Equations	(2.7)
Properties and Operations	(1.3)
Quadratic Equations	(2.5)
Circles and Parabolas	(3.4)
Angles and their Measurements	(7.1)
Trigonometric Functions of Acute Angles	(7.2)
Exponential Functions	(6.1)
Exponential Equations and Applications	(6.4)

THE OHIO STATE UNIVERSITY

Course Coordinator:
Crichton Ogle
1998-99

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

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:

College Algebra and Trigonometry , Dwyer and Gruenwald.

Technology: All students are required to have a graphing calculator. Most instructors will be familiar with the Texas Instruments TI-83.

Topics:

functions	(4.1)
graphs	(4.2)
combinations and inverses of functions	(4.3)
linear and quadratic functions	(4.4)
polynomial functions	(5.1)
division, zeros and factors of polynomials,	(5.2)-(5.3)
rational functions	(5.5)
exponential functions	(6.1)
logarithmic functions	(6.2)
logarithmic equations	(6.3)
exponential equations	(6.4)
angles	(7.1)
trigonometric functions of angles	(7.2)
trigonometric functions of real numbers	(7.3)
graphs of trig functions	(7.4)-(7.5)
inverse trig functions	(7.6)
trigonometric identities	(8.1)
addition formulas	(8.2)
double and half angle formulas	(8.3)
conditional trigonometric equations	(8.4)
law of sines	(9.1)
law of cosines	(9.2)

THE OHIO STATE UNIVERSITY

Course Coordinator:
Daniel B. Shapiro
1998-99

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

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

THE OHIO STATE UNIVERSITY

Course Coordinator:
Zbigniew Fiedorowicz
1998-99

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

THE OHIO STATE UNIVERSITY

Course Coordinator:
Zbigniew Fiedorowicz
1998-99

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

THE OHIO STATE UNIVERSITY

Course Coordinator:
Phil Huneke
1998-99

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

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

THE OHIO STATE UNIVERSITY

Course Coordinator:
Phil Huneke
1998-99

Mathematics 151C	**5 cr.**	**Calculus and**
Mathematics 152C	**5 cr.**	**Analytic Geometry**
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

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For further information see:
Tony Nance
1998-99

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

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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
1998-99

Mathematics H161	**Au**	**5 cr.**	**Accelerated Calculus**
Mathematics H162	**Wi**	**5 cr.**	**and Analytic Geometry**
Mathematics H263	**Sp**	**5 cr.**	

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 not correct; 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:

Calculus with Analytic Geometry, 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.

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For Further Information See:
V. Bergelson (Honors)
1998-99

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

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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)
1998-99

SPECIAL CALCULUS OPTIONS 1998-1999

THE OHIO STATE UNIVERSITY

1) Math 140, 141

140-Au 98, 141-Wi 99

Purpose: This two quarter sequence is intended for beginning students who (i)aim at a major which requires at least through the 152 level, (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. Its purpose is to equip such students to succeed in 152 in the Spring Quarter.

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: The two courses together cover the topics in differential calculus as listed in 151. The assignments are longer and more searching than is feasible in a standard pace course. The student thereby reinforce their mastery of algebra, analytic geometry, and trigonometry.

Follow-up Course: Students who succeed in both 140 and 141 are prepared for 152. Students failing either course or dropping out of the sequence at any time must meet with the math counselors for rerouting specific to their situation.

For Further Information See:
Frank Carroll
1998-99

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. They were official renamed 161G, 162G, 263G in 97-98.

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. 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
1998-99

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

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Course Coordinator:
Yuval Flicker
1998-99

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

Prerequisite:

Mathematics 254.

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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
1998-99

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.

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Text:

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

(Over for Topics)

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

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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
1998-99

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

Prerequisite:

Mathematics 254

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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:

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

Topics:

2.1,2.2	Linear first order differential equations
2.3,2.4	Separable equations; differences between linear and non linear equations
2.5,2.6,2.7	Selected applications in population dynamics and mechanics
2.8	Exact Equations
3.1,3.2	Homogeneous equations with constant coefficients; fundamental solutions
3.3,3.4	Linear independence, the Wronskian; complex roots of characteristic equation
3.5	Repeated roots; reduction of order
3.6	Non homogeneous equations; method of undetermined coefficients
3.7	Variation of parameters
3.8,3.9	Mechanical and electrical vibrations; forced vibrations
5.1,5.2	Power series; series solutions near an ordinary point
10.1	Separation of variables; heat conduction
10.2,10.3	Fourier Series; Fourier Theorem
10.4,10.5	Even and odd functions; solution of other heat conduction problems
10.6	The wave equation: vibrations of an elastic string
10.7	Laplace's Equation

Course Coordinator:
George Majda
1998-99

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

Prerequisite:

Permission of Department.

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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)
1998-99

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

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 required.

Texts:

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.
A History of Mathematics - An Introduction, Victor J. Katz (2nd Ed).

Topics and Assignments:

The topics and assignments will vary based on the instructors.

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Course Coordinator:
B. Wyman
1998-99

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

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Course Coordinator:
Joe Ferrar
1998-99

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

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

THE OHIO STATE UNIVERSITY

Audience

Designed for in-service teachers.

Course Coordinator:
Not Currently Offered
1998-99

Mathematics 512 **3 cr.** **Partial Differential Equations and Boundary Value Problems**
A, W, Sp, Su (1st Term)

Prerequisite:

Mathematics 255 or 415 or 556.

THE OHIO STATE UNIVERSITY

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
1998-99

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

Prerequisite:

Mathematics 254

THE OHIO STATE UNIVERSITY

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
1998-99

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

THE OHIO STATE UNIVERSITY

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
1998-99

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

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Course Coordinator:
V. Bergelson (Honors)
1998-99

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.

THE OHIO STATE UNIVERSITY

Text:

Probability, Jim Pitman.

Topics:

Sets
Counting
Independence and conditioning
Limit theorems

Probability
Random Variables
Mean, variance

Course Coordinator:
Neil Falkner
1998-99

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

*** OFFERED IN ODD YEARS ONLY (Wi 1995, Wi 1997, WI 1999)**

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)

THE OHIO STATE UNIVERSITY

For Further Information See:
V. Bergelson (Honors)
1998-99

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

*** OFFERED IN ODD YEARS ONLY (Sp 1995, Sp 1997, Sp 1999)**

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)

THE OHIO STATE UNIVERSITY

For Further Information See:
V. Bergelson (Honors)
1998-99

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

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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
1998-99

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

Prerequisite:

Mathematics 547

Catalog Description:

Continuation of 547

Purpose of Course:

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

Follow-up Course:

Math 549 or 551 or 552.

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. 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.

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Course Coordinator:
Bogdan Baishanski
1998-99

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

Prerequisite:

Mathematics 548.

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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
1998-99

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

Prerequisite:

Mathematics 254

THE OHIO STATE UNIVERSITY

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
1998-99

Mathematics 552
Wi, Su

5 cr.

Introduction to the Theory of Functions of a Complex Variable

THE OHIO STATE UNIVERSITY

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

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
1998-99

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

THE OHIO STATE UNIVERSITY

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
1998-99

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

Prerequisite:

Mathematics 556

THE OHIO STATE UNIVERSITY

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
1998-99

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

THE OHIO STATE UNIVERSITY

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:

Topological Spaces, Buskes and Van Rooij (Springer)

(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
1998-99

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

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

Prerequisite:

Mathematics 366.

THE OHIO STATE UNIVERSITY

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
1998-99

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 linear algebra with geometric interpretations in the space $\mathbb{R}^n$. Emphasis is on techniques, computational skills, and fundamental concepts.

Follow-up Course:

None.

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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 transformations (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
1998-99

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.

This course was last offered Wi 98 and is not projected to run for this year.

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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

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Course Coordinator:
Ed Overman
1998-99

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

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Course Coordinator:
Ed Overman
1998-99

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.

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Course Coordinator:
Paul Ponomarev
1998-99

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

This course, under the current description, is not projected to run in Sp 2000.

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.

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Course Coordinator:
Joe Ferrar
1998-99

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

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, H.J. Straight

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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
1998-99

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

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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
1998-99

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

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Follow-Up Course:

Math 581

Topics:

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

Course Coordinator:
Ron Solomon
1998-99

Mathematics 581 **3 cr.** **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

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Topics:

More elementary number theory, theory of equations, ring theory, group theory, ruler and compass constructions.

Course Coordinator:
Ron Solomon
1998-99

Mathematics 582 **3 cr.** **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

THE OHIO STATE UNIVERSITY

Topics:

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

Course Coordinator:
Ron Solomon
1998-99

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)

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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)
1998-99

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

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Note: Math 616 will not be offered in 1999-2000

For further information see:
Bostwick Wyman
1998-99

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

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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.

Special Note: This course will be offered in WI 99 and again in Au 99 in an accelerated format for students who want to take the S.O.A. course 140 exam. In view of S.O.A. and C.A.S. exam changes, the syllabus will be revised for later offerings.

For further information see:
Bostwick Wyman
1998-99

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)

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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., 2nd edition, Newton L. Bowers, Jr., et al, Society of Actuaries, 1997.
Life Contingencies, A Guide for the Actuarial Student ., 2nd edition, R. W. Batten, 1998.

The following is a useful references:

Life Contingencies, C. W. Jordan

(Over for Topics)

Topics List

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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 Notes:

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

In light of the changes in the S.O.A. and C.A.S. examinations, effective in May 2000, the syllabus for this course will be revised for 1999-2000.

For further information see:
Bostwick Wyman
1998-99

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

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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
1998-99

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.

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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:
S. Berberian, A First Course in Real Analysis
651: Chapters 1-4, 10; 652: Chapters 5-9; 653: Chapter 11 and supplementary material

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

For Further Information see:
Gerald Edgar
1998-99

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

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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

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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
1998-99

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

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(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.

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For Further Information See:
Joe Ferrar
1998-99

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

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
10.6:	The Wave Equation--Derivation, Solution and Applications
6.1-6.3,6.6:	Laplace Transform, Solution of Ordinary Differential Equations, Shifting Theorems, Convolution

For More Information See:
George Majda
1998-99