Department of Mathematics
The Ohio State University

2003-2004 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	Fundamental Mathematics Concepts for Teachers I
106	Fundamental Mathematics Concepts for 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
140	Calculus with Review I
141	Calculus with Review II
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
188	Invitation to Actuarial Science
254	Calculus and Analytic Geometry
151A	Calculus and Analytic Geometry
152A	Calculus and Analytic Geometry
153A	Calculus and Analytic Geometry
254A	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

Course Number	Course Title
161G	Accelerated Calculus with Analytic Geometry I
162G	Accelerated Calculus with Analytic Geometry II
263G	Accelerated Calculus with Analytic Geometry III
161H	Accelerated Calculus with Analytic Geometry
162H	Accelerated Calculus with Analytic Geometry
263H	Accelerated Calculus with Analytic Geometry
187H	Advanced Problem Solving
487H	Advanced Problem Solving
190H	Elementary Analysis I
191H	Elementary Analysis II
264H	Elementary Analysis III
255	Differential Equations and Their Applications
255C	Differential Equations and Their Applications
345	Foundations of Higher Mathematics
366	Discrete Mathematical Structures I
414	Group Studies: Differential Equations for Engineering Applications
415	Ordinary and Partial Differential Equations
415C	Ordinary and Partial Differential Equations
504	History of Mathematics
507	Advanced Geometry
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
532	Mathematical Foundations of Actuarial Science
540H	Geometry and Calculus in Euclidean Spaces and on Manifolds I
541H	Geometry and Calculus in education 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
566	Discrete Mathematical Structures II
568	Introductory Linear Algebra I
571	Linear Algebra for Applications I
572	Linear Algebra for Applications II
573	Elementary Number Theory

Course Number	Course Title
575	Combinatorial Mathematics & Graph Theory
576H	Number Theory Through History I
577H	Number Theory Through History II
578	Discrete Mathematical Models
580	Algebra I
581	Algebra II
582	Algebra III
588	Practicum in Actuarial Science
590H	Algebraic Structures I
591H	Algebraic Structures II
592H	Algebraic Structures III
601	Mathematical Principles in Science I
602	Mathematical Principles in Science II
603.02	Mathematical Principles in Science III, B
618	Theory of Interest
630	Actuarial Mathematics I
631	Actuarial Mathematics II
632	Actuarial Mathematics 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

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

Prerequisite:

Course Code T on Math Placement Test.

Catalog Description:

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

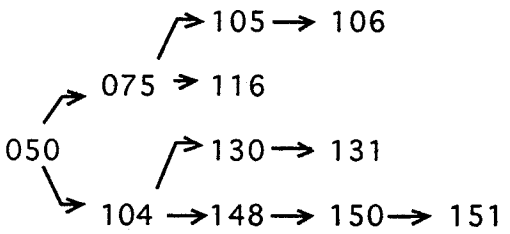
Purpose of Course:

Mathematics 050 is designed to meet the needs of the students entering The Ohio State University at the lowest placement, course code T. This course will prepare students for 075 or 104. Math admissions 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, 3rd ed.

(Over for Topics List and Sample Syllabus)

Topics List & Sample Syllabus

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

Course Coordinator:
Lee McEwan
2003-2004

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

Prerequisite:

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

Catalog Description:

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

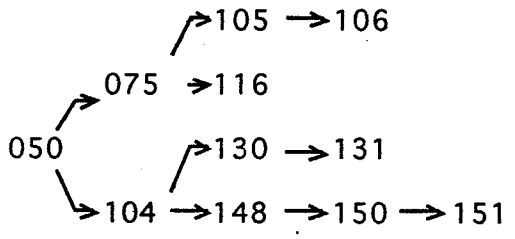
Purpose of Course:

To meet the needs of students entering the University with Course Code S on Math Placement Test, or with credit for 050. 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 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, or pre-certification programs.

Sequencing Chart:



Text:

Beginning Algebra, (3rd ed.) Martin-Gay

(Over for Topics List & Sample Syllabus)

Topics List & Sample Syllabus

Sections	Topics
5.5	FACTORING STRATEGIES FOR POLYNOMIALS
6.1–6.8	RATIONAL EXPRESSIONS Simplifying rational expressions Multiplying and dividing rational expressions Adding and subtracting rational expressions Least common denominator Simplifying complex fractions Solving rational equations Ratio and proportion Rational equations and problem solving
	Review and first midterm
3.4, 7.1, 7.2	LINEAR EQUATIONS Slope Slope-intercept form Point-slope form
8.1–8.4	SYSTEMS OF LINEAR EQUATIONS Solving systems of linear equations by graphing Solving systems of linear equations by substitution Solving systems of linear equations by elimination Systems of linear equations and problem solving Systems of linear inequalities
3.5, 8.5	LINEAR EQUATIONS 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
2003-2004

Mathematics 076 **4 cr.** **Reentry Precollege Math**
Wi

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.

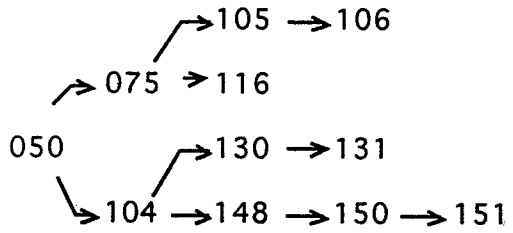
Purpose of Course:

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, or pre-certification programs.

Sequencing Chart:



Text:

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

(Over for Topics List)

Topics List

1. Arithmetic of signed numbers

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

3. Word problems

4. Solving linear equations and inequalities

5. Graphs of equation

6. Linear equations
   standard form; slope - intercept form

7. Parallel and perpendicular lines

8. Systems of linear equations

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

10. Factoring polynomials
    common monomial factor
    quadratics
    by grouping

11. Rational roots and factors

12. Fractional exponents

13. Simplifying radical expressions

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

15. Negative exponents

16. Simplifying rational expressions

17. Solution of fractional equations and applications

Course Coordinator:
Gloria Woods
2003-2004

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

Catalog Description:

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

Prerequisite:

New first quarter freshman, no math admission condition (i.e. 3 or more units of college prep math), optional for Math Placement T (may take 050 or 103/104) and Math Placement S (may take 050, 075, or 103/104); Concurrent enrollment in Math 104 required.

Purpose of Course:

This course offers an opportunity for at-risk NFQF [Math Course Code T and S] to develop the skills needed to learn Math. Enrollment in 103 enables code T and S students to concurrently enroll in Math 104, in place of registration in Math 050 or 075.

Follow-up course:

Students in 103 who also successfully complete 104 are then eligible for 116, 130 or 148.

Text:

Materials used parallel the content of Math 104 while enhancing students' ability to "process" and "strategize" the mathematics.

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Course Coordinator:
Harry Allen
2003-2004

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

Prerequisite:

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

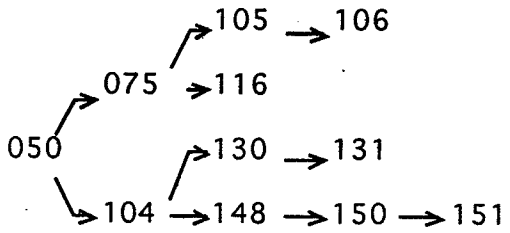
Purpose of Course:

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.

Sequencing Chart:



Text:

Understanding Intermediate Algebra: A Course for College Students, 5th ed.; Hirsch/Goodman. ISBN 0-534-38125-1

(Over for Topics List and Sample Syllabus)

Topics List & Sample Syllabus

Section	Topics
1.4/2.1	Equations as Mathematical Models
1.5/2.2	First Degree Equations and Applications
2.3	First –Degree Inequalities and Applications (Interval Notation)
3.1	The Rectangular Coordinate System and Graphing Straight Lines
3.2	Graphs and Equations
3.3	Relations and Functions: Basic Concepts
3.4	Functional Notation
4.1	Straight Lines and Slope
4.2	Equations of a Line and Linear Functions as Mathematical Models
4.3	Linear Systems in Two-Variables
	Review and Exam 1
5.3	General Forms and Special Products
5.4	Factoring Out the Greatest Common Factor
5.5	Factoring Trinomials
6.1	Rational Functions
6.2	Equivalent Fractions
6.3	Multiplication and Division of Rational Expressions
6.4	Sums and Differences of Rational Expressions
6.5	Mixed Operations and Complex Fractions
6.6	Fractional Equations and Inequalities
6.7	Literal Equations
6.8	Applications: Rational Functions and Equations as Mathematical Models
	Review and Exam 2
7.3	Rational Exponents and Radical Notation
7.4	Simplifying Radical Expressions
7.5	Adding and Subtracting Radical Expressions
7.6	Multiplying and Dividing Radical Expressions
7.7	Radical Functions and Equations
8.1	Quadratic Functions as Mathematical Models
7.8	Complex Numbers
8.2	Solving Quadratic Equations: The Factoring and Square Root Methods
8.3	Solving Quadratic Equations: Completing the Square
8.4	Solving Quadratic Equations: The Quadratic Formula
8.5	Equations Reducible to Quadratic Form (and More Radical Equations)
8.6	Graphing Quadratic Functions
	Review and Exam 3
9.3	Types of Functions

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Course Coordinator:
David George
2003-2004

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

**Currently being taught in either lecture/recitation or workshop format.*

Prerequisite:

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

Catalog Description:

Development of basic ideas of arithmetic, algebra, and geometry as appropriate for 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 elementary and middle school mathematics programs. Math 105 deals with the whole number system, integers, rational numbers, and combinatorial counting techniques.

Follow-up Course:

Math 106

Text:

Mathematics for Elementary Teachers, 6th Ed., Musser & Burger; (lecture/recitation format)
OSU Math 105 Supplements/Labs

Published notes (workshop format)

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(Over for Topics List)

Topics List for Math 105

I. Foundations
- A. Sets
  - what is a set: notation, extension property; Venn diagrams
  - subsets, unions, intersections, complements
- B. Logic
  - informal logic; formal logic; and truth tables and deduction
- C. Operations (see Whole Numbers, below)

II. Whole Numbers and Their Properties
- A. Counting
  - one-to-one correspondence; inclusion-exclusion; cartesian products
- B. Factors
  - prime numbers, unique prime factorization, counting factors
  - LCM: how to obtain it; properties of the LCM
  - GCD: how to obtain it; properties of the GCD
- C. Negative Numbers
  - interpretation and rules for manipulation
- D. Properties of Operations
  - abstract operations: commutativity, associativity, identities, inverses
  - properties (and consequences) of: addition, multiplication, subtraction, and division
  - distributivity
- E. Place Value
  - how our numeration system works and other bases
  - algebraic representation of numbers in terms of their digits
  - negative place value and decimals (see Decimals, below)
- F. Common Algorithms
  - understanding algorithms; justification of addition, multiplication, subtraction, division

III. Division and Fractions
- A. Division
  - inverse of multiplication, repeated subtraction, division algorithms and fractions.
- B. Ratio and Proportion
  - proportionality word problems; recognizing given data in terms of proportion
  - cross-multiplication and its justification
- C. Fractions
  - models of fractions; equivalent fractions and cross-multiplication; mixed vs. improper fractions
  - adding and subtracting fractions; multiplication and division of models and procedures.
- D. Decimals
  - place value; terminating decimals to fractions; classification of fractions as terminating or repeating decimals
- E. Scientific Notation
  - definition and conversion; estimation of physical qualities, approximate computation in scientific notation, and logarithmic scale (intro)
- F. Percentages
  - representation as a fraction or decimal; percentage increase or decrease

IV. General Skills and Attitudes
- A. Problem Solving Strategies
  - trial and error; reducing the problem; numbers instead of variables; harnessing physical intuition
- B. Generalization and Abstraction
  - observing patterns; expressing observations; using variables to express and justify observations; broadening the scope
- C. Word Problems
  - understanding what is asked; unambiguous usage of variables; units; writing equations
- D. Broader Context
  - NCTM Standards for active learning, justification/proof, verbalizing; articulate and grammatical mathematical expression; argumentation

Course Coordinator:
Vic Ferdinand
2003-2004

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

**Currently being taught in either lecture/recitation or workshop format.*

Prerequisite:

Mathematics 105 or written permission of the department. Math 106N is open only to Rank 4 and GRD EDU students, and to students who have applied to the M. Ed program.

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 elementary and middle school mathematics programs. Math 106 introduces length, area, volume, angle, Euclidean geometry, congruent and similar triangles, symmetry and rigid motion, and knowledge of general spatial skills.

Follow-up Course:

Math 107

Text:

Mathematics for Elementary Teachers, 6th ed., Musser & Burger. (lecture/recitation format)
OSU Math 106 Supplements/Labs

Published Notes (workshop format)

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(over for Topics List)

Topics List for Math 106

I. Length
- A. Measurement
  - need for standard units; units and comparison; successful measurement
- B. Length and Distance
  - length of a curve; distance in cartesian coordinates
- C. Behavior under Scaling and Change of Units

II. Area
- A. Defining Area
  - conservation of area; comparing by dissecting and rearranging pieces; areas of irregular shapes; units of area; surface area
- B. Area Formulae
  - rectangles; triangles; justification of formulae (parallelogram/trapezoid/circle); applications
- C. Behavior under Scaling and Change of Units
  - proportionality to the square; two-dimensionality; independence of area and perimeter

III. Volume
- A. Defining Volume
- B. Prisms and Cylinders
  - product formulae; right vs. oblique cylinders; pyramids and cones
- C. Behavior under Scaling and Change of Units
  - proportionality to the cube; three-dimensionality; independence of volume and surface area

IV. Angle
- A. Defining and Measuring Angles
  - using a protractor; alignment and orientation; units of angle
- B. Summing Angles
  - adding adjacent angles; summing angles of a triangle; summing interior angles of a polygon
- C. Behavior under Scaling and Change of Units
  - zero-dimensionality; independence of angle from linear measure of subtended chord; similarity; applications

V. Euclidean Geometry
- A. Axiomatic Reasoning
  - Euclid's axioms; rigidity; proofs of some simple facts; motivation for euclidean rigor
- B. Constructions with Straightedge and Compass
  - relation to the axioms; basic constructions; proving your construction works
- C. New Proofs of Old Formulas
  - rigorizing proof of area formulae; pythagorean theorem

VI. Symmetry and Rigid Motion
- A. Rigid Motions
  - reflections, rotations, translations; composing rigid motions
- B. Symmetry of Plane Figures
  - reflections and lines of symmetry; rotations and centers of symmetry; finding all symmetries
- C. Tesselations and Their Symmetries
  - translation symmetry; wallpaper patterns; classification of regular/semi-regular tesselations
- D. Three-Dimensional Shapes
  - Platonic solids; planes of reflection; axes of rotation; symmetries of regular and other polyhedras

VII. General Skills
- A. Spatial Imagination
- B. Drawing and Sketching
- C. Vocabulary
- D. Broader Context: Role of Geometric Intuition in Mathematical Concept Formation

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Course Coordinator:
Vic Ferdinand

2003-2004

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.

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 elementary and middle school mathematics programs. Math 107 deals with combinatorics, probability, functions, sequences and series, logic, compound interest, and general mathematical skills.

Text:

Instructor's Notes.

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Topics List

I. Combinatorics
- A. Cartesian Products and Power Sets (review)
- B. Combinations and Permutations
- C. Binomial Coefficients

II. Probability
- A. Probability Spaces
- B. Independence and Conditional Probability
- C. Combinatorial Probability
- D. Law of Large Numbers

III. Functions
- A. General Functions
- B. Famous Functions

IV. Sequences and Series
- A. General Sequences
- B. Series

V. Logic
- A. Review of Propositional Logic: the converse and contrapositive
- B. Qualifiers
- C. Analysis of Arguments
- D. Classic Proofs

VI. Compound Interest
- A. What is Compound Interest?
- B. Computing

VII. General Skills
- A. Estimation and Mental Calculation
- B. Recursive Use of Notation
- C. Broader Context

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Course Coordinator:
Vic Ferdinand
2003-2004

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

*(*Offered in Autumn on regional campuses only.)*

Prerequisite:

Mathematics 075 or 076 or 104 or course code R on Math Placement Test.

Catalog Description:

Critical thinking & problem solving, with relevant topics met in everyday life; appropriate for majors in the 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.

Text:

Excursions in Modern Mathematics, 4 ed, Tannenbaum/Arnold

Topics List:

Euler circuits
Graphs, Euler's theorem, Fleury's algorithm for an Euler circuit,, Eulerizing graphs

Traveling Salesman Problem
Hamilton circuits and paths, complete graphs, simple strategies for TSP, algorithms for approximate TSP solutions

Networks
Trees, minimum spanning trees, Kruskal's algorithm for finding minimum spanning trees

Voting
Preference ballots, five different methods of determining the winner of an election with 3 or more candidates

Apportionment
Some U.S. history on congressional districts, basic concepts, Hamilton's method, quota rule, Alabama paradox

Spiral growth in nature
Fibonacci numbers, golden ratio , the equation $x^2 = x + 1$

Population growth
Its dynamics, exponential growth models, logistic growth models

Probability, sample spaces, counting principles, permutations and combinations, probability spaces, equally likely outcomes

Symmetry
Geometric symmetry, rigid motions, reflections, rotations, translations

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Course Coordinator:
Tom Dowling
2003-2004

Mathematics 117 **5 cr.** **Survey of Calculus**
Au, Wi, Sp

Prerequisite:

Mathematics 148, 150, Course Code M, or Permission from the Math Department

Catalog Description:

An introduction to differential and integral calculus.

Purpose of Course:

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 Early Childhood and Middle Childhood Ed. students doing a Math Concentration. The intent of the course is to provide students with basic concepts and skills associated with calculus, along with the applications of the topic.

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:

Calculus: Early Transcendentals. Custom Version for Ohio State University, 10th Edition, Thomas. Published by Addison-Wesley, 2001.

Calculator:

A graphing calculator is required for this course. Most instructors will be familiar with the Texas Instrument TI-83. NOTE: The TI-89, TI-92, and any calculator that uses a Computer Algebra System are not allowed in this course.

(Over For Topics List And Sample Syllabus)

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Topics List & Sample Syllabus

Sections	Topics
0.7	Modeling Change
1.1	Rates of Change and Limits
1.5	Tangent Lines
2.1	The Derivative as a Function
2.2	The Derivative as a Rate of Change
2.3	Derivatives of Products, Quotients, and Negative Powers
2.5	The Chain Rule
2.4	Derivatives of Trigonometric Functions
2.8	Derivatives of Inverse Trigonometric Functions
2.9	Derivatives of Exponential and Logarithmic Functions
3.1	Extreme Values of Functions
3.3	The Shape of a Graph
3.5	Modeling and Optimization
3.6	Linearization and Differentials
	Exam I
4.1	Indefinite Integrals, Differential Equations, and Modeling
4.3	Estimating with Finite Sums
4.4	Riemann sums and Definite Integrals
4.5	Fundamental Theorem of Calculus
4.2	Integral Rules: Integration by Substitution
4.6	Substitution of Definite Integrals
7.5	Integral Tables
4.7	Numerical Integration
5.1	Volumes by Slicing and Rotating about an Axis
5.2	Modeling Volume by Cylindrical Shells
5.3	Lengths of Plane Curves
(Supplement)	Surface Area
5.5	Springs, Pumping, and Lifting
5.6	Fluid Forces
5.7	Moments and Centers of Mass
	Exam II
	Review and/or Additional Topics in Chapter 11, 12

To be Referred to in Appropriate Sections:

11.1	Functions of Several Variables
11.3	Partial Derivatives
11.6	Linearization and Differentials
11.7	Extreme Values and Saddle Points
12.1	Double Integrals
12.2	Areas, Moments, and Centers of Mass
12.4	Triple Integrals
12.6	Masses and Moments in Three Dimensions

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Course Coordinator:
Victor Ferdinand
2003-2004

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:

Math 130 is a pre-calculus course with a finance section slanted toward a business program. The applications are business related.

Follow-up Course:

Math 131

Text:

Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Haeussler & Paul, 10th ed.

Topics & Sample Syllabus

Sections	Topics
2.1/2.2	Applications of Equations, Linear Equations
2.3/3.1	Applications of Inequalities
3.2/3.4	Special Functions, Graphs in Rectangular Coordinates
4.1/4.2	Lines, Applications, and Linear Functions
4.3/4.4	Quadratic Functions, System of Linear Equations
4.5/4.6	Nonlinear Systems, Applications of Systems of Equations
5.1	Exponential Functions
5.2/5.3	Logarithmic Functions, Properties of Logarithms
5.4	Logarithmic and Exponential Equations
8.1/8.2	Compound Interest, Present Value
8.3/8.4	Annuities, Amortization of Loans
6.1/6.2	Matrices, Matrix Addition, and Scalar Multiplication
6.3/6.4	Matrix Multiplication, Method of Reduction

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Course Coordinator
Gloria Woods
2003-2004

Math 131 **4 cr.** **Mathematical Analysis for Business II**
Au, Wi, Sp, Su

Prerequisite:

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

Catalog Description:

Differential Calculus- limits, definition of derivative, calculation of derivatives, curve sketching, and applications.

Purpose of Course:
Math 131 is designed to introduce students in the College of Business to differential calculus and related business applications.

Text:

Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Haeussler & Paul, 10th ed.

Topics and Sample Syllabus

Sections	Topics
11.1	Limits
11.2	Limits(con't)
11.4	Continuity
11.5	Continuity Applied to Inequalities
12.1	The Derivative
12.2	Rules for Differentiation
12.3	The Derivative as a Rate of Change
12.5	Product and Quotient Rules
12.6	The Chain Rule and the Power Rule
13.1	Derivatives of the Logarithmic Functions
13.2	Derivatives of Exponential Functions
13.3	Implicit Differentiation
13.4	Logarithmic Differentiation
13.5	Higher Order Derivatives
14.1	Relative Extrema
14.2	Absolute Extrema on a Closed Interval
14.3	Concavity
14.4	Second Derivative Test
14.5	Asymptotes
15.1	Applied Maxima and Minima

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Course Coordinator
Phil Hanneke
2003-2004

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

Prerequisite:

Mathematics 131 or 151

Catalog Description:

Integral Calculus-Indefinite integration, area and definite integrals, improper integrals, functions of several variables, maxima, and minima.

Purpose of Course:

Math 132 is designed to introduce students in the College of Business to integral and multivariable calculus. The course is problem oriented with emphasis on business applications.

Text:

Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, 10th edition, by Ernest Haeussler/Richard S. Paul, Chapters 15-19.

Sections	Topics
15.2	Differentials
16.1	The Indefinite Integral
16.2	Integration with Initial Conditions
16.3	More Integration Formulas
16.4	Techniques of Integration
16.5	Summation
16.6	The Definite Integral
16.7	The Fundamental Theorem of Calculus
16.8	Area
16.9	Area Between Curves
16.10	Consumer Surplus and Producers Surplus
17.1	Integration by Parts
17.2	Integration by Partial Fractions
17.3	Integration by Tables
17.4	Average Value of a Function
17.5	Approximate Integration
17.6	Differential Equations
17.8	Improper Integrals
19.1	Functions of Several Variables
19.2	Partial Derivatives
19.3	Applications of Partial Derivatives
19.4	Implicit Partial Derivatives
19.5	Higher Order Partial Derivatives
19.7	Maxima and Minima for Functions of Two Variables
19.8	Lagrange Multipliers

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Course Coordinator:
Surinder Sehgal
2003-2004

Mathematics 140	**Au**	**5 cr.**	**Calculus with Review I**
Mathematics 141	**Wi**	**5 cr.**	**Calculus with Review II**

Prerequisite:

Level N placement (i.e. placement into Math 148), 4 years of college preparatory math in high school, and some exposure to Calculus. Designed for new first quarter freshmen.

Catalog Description:

140: Review of polynomial and rational functions, difference quotients, limits, continuity, derivatives, chain rule, higher order derivatives, implicit differentiation, related rates.

141: Trigonometric review, differentiation of the trigonometric functions, review of exponential and logarithmic functions, mean value theorem, applications to curve sketching, applied maxima and minima problems.

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 to Math 152), 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.

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.

Text:

Calculus (8th edition); Varberg, Purcell, Rigdon. 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 students, thereby reinforce their mastery of algebra, analytic geometry, and trigonometry.

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Course Coordinator:
Bostwick Wyman
2003-2004

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 which involve solving linear and quadratic equations, system of equations, variation, trigonometry of acute angles, law of sines and cosines, vectors, and exponential (resp. logarithmic) 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:

Contemporary College Algebra and Trigonometry OSU Custom Edition (2003 – 2004), Hungerford

Technology: All students are required to have a graphing calculator.

Topics List

Sections	Topics
1.1	Graphs
1.2	Solving Equations Graphically Part 1: The Root Method
1.3	Solving Equations Graphically Part 2: The Intersection Method
2.1	First-Degree Equations and Applications
2.2	Quadratic Equations and Applications
2.3	Maximum and Minimum Applications
3.1	Functions
3.2	Functional Notation
5.1	Exponential Functions
5.2	Applications of Exponential Functions
5.3	Common and Natural Logarithm Functions
5.4	Properties of Logarithms
5.5	Algebraic Solutions of Exponential and Logarithmic Equations
6.1/6.2	Variation & Arclength and Area of a Circular Sector
6.3	Geometry: Similar Triangles
9.1	Trigonometric Functions of Acute Angles
9.2	Applications of Right Triangle Trigonometry
9.3	The Law of Cosines
9.4	The Law of Sines

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Course Coordinator:
David George
2003-2004

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:
Algebra and Trigonometry-Enhanced with Graphing Utilities, Sullivan and Sullivan, 3rd ed.

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

Sections	Topics
2.1	Functions
3.1	Symmetry: Graphing Key Equations
3.2	Properties of Functions
3.3	Library of Functions: Piecewise-Defined Functions
3.4	Graphing Techniques: Transformations
4.1	Power Functions and Models
4.2	Polynomial Functions and Models
4.3	Rational Functions I
4.4	Rational Functions II: Analyzing Graphs
4.5	Polynomial and Rational Inequalities
6.1	One-to-One Functions: Inverse Functions
6.2	Exponential Functions
6.3	Logarithmic Functions
6.4	Properties of Logarithms
6.5	Logarithmic and Exponential Functions
8.1	Angles and Their Measure
8.2	Right Triangle Trigonometry
8.3	Computing the Values of Trigonometric Functions of Given Angles
8.4	Trigonometric Functions of General Angles
8.5	Properties of the Trigonometric Functions: Unit Circle Approach
8.6	Graphs of the Sine and Cosine Functions
8.7	Graphs of the Tangent, Cotangent, Cosecant, and Secant Functions
8.8	Phase Shift: Sinusoidal Curve Fitting
9.1	The Inverse Sine, Cosine, and Tangent Functions
9.2	Inverse Trigonometric Functions (continued)
9.3	Trigonometric Identities
9.4	Sum and Difference Formulas
9.5	Double-Angle and Half-Angle Formulas
9.7	Trigonometric Equations I
9.8	Trigonometric Equations II
11.1	Polar Coordinates
11.2	Polar Equations and Graphs
11.3	Complex Plane: De Moivre's Theorem

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Course Coordinator:
Paul Ponomarev
2003-2004

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

**Book change occurred in Autumn 2003*

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, Dale Varberg, Edwin J. Purcell, and Steven E. Rigdon, 8th edition.

Topics & Sample Syllabus:

Sections	Topics
2.1	Functions and Their Graphs
2.2	Operations on Functions
2.3	Trigonometric Functions
2.4	Introduction to Limits
2.5	Rigorous study of limits
2.6	Limit Theorems
2.7	Limits Involving Trigonometric Functions
2.8	Limits at Infinity, Infinite Limits
2.9	Continuity of Functions
3.1	Slope of a tangent line and instantaneous velocity
3.2	The Derivative
3.3	Rules for finding Derivatives
3.4	Derivatives of Trigonometric Functions
3.5	The Chain Rule
3.6	Leibniz Notation
3.7	Higher-Order Derivatives
3.8	Implicit Differentiation
3.9	Related Rates
3.10	Differentials and Approximations
4.1	Maxima and Minima
4.2	Monotonicity and concavity
4.3	Local Maxima and Minima
4.4	More max-min problems
4.5	Economic Applications
4.6	Sophisticated Graphing
4.7	The Mean-Value Theorem
5.1	Antiderivatives

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Course Coordinator:
Zbigniew Fiedorowicz
2003-2004

Mathematics 152 **5 cr.** **Calculus and Analytic Geometry**
Au 2003

**Book change occurred in Wi 2004 (see next page for Wi, Sp, Su 2004)*

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 with Analytic Geometry by Ellis and Gulick, 5th ed.

(Over for Topics List & Sample Syllabus)

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Topics List & Sample Syllabus (for Autumn 2003)

Sections	Topics
5.1	Preparation for the Definite Integral
5.2	The Definite Integral
5.3	Special Properties of the Definite Integral
5.4	The Fundamental Theorem of Calculus
5.5	Indefinite Integrals and Integration Rules
5.6	Integration by Substitution
5.7	The Logarithm
5.8	Another Look at Area
	Review and Midterm #1
6.1	Inverse Functions
6.2	The Natural Exponential Function
6.3	General Exponential and Logarithmic Functions
6.5	The Inverse Trigonometric Functions
6.6	L'Hôpital's Rule
6.7	Introduction to Differential Equations
6.8	Methods of Solving Differential Equations
7.1	Integration by Parts
	Review and Midterm #2
7.2	Trigonometric Integrals
7.3	Trigonometric Substitutions
7.4	Partial Fractions
7.5	Integration by Tables and Symbolic Integration
7.6	The Trapezoid Rule and Simpson's Rule
7.7	Improper Integrals
8.1	Volume: The Cross-Sectional Method
8.2	Volume: The Shell Method
	Review and Midterm #3
8.3	Length of a Curve
8.4	Area of a Surface
One of the following:	
8.5	Work
8.6	Moments and Center of Gravity
8.7	Hydrostatic Force
	Review and Final Exam

Course Coordinator:
Zbigniew Fiedorowicz
2003-2004

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

**Book change occurred in Winter 2004*

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, Dale Varberg, Edwin J. Purcell, and Steven Rigdon, 8th edition.

(Over for Topics List & Sample Syllabus)

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Topics List & Sample Syllabus

Sections	Topics
5.2	Introduction to Differential Equations
5.3	Sums and Sigma Notation
5.4	Introduction to Area
5.5	The Definite Integral
5.6	The First Fundamental Theorem of Calculus
5.7	The Second Fundamental Theorem of Calculus
5.8	Evaluating Definite Integrals
6.1	The Area of a Plane Region
6.2	Volumes of Solids: Slabs, Disks, Washers
6.3	Volumes of Revolution: Shells
6.4	Length of a Plane Curve
7.1	The Natural Logarithm Function
7.2	Inverse Functions and Their Derivatives
7.3	The Natural Exponential Function
7.4	General Exponential and Logarithmic Functions
7.5	Exponential Growth and Decay
7.7	The Inverse Trigonometric Functions and Their Derivatives
8.1	Integration by Substitution
8.2	Some Trigonometric Integrals
8.3	Rationalizing Substitutions
8.4	Integration by Parts
8.5	Integration by Rational Functions
9.1	Indeterminate forms of type 0/0
9.2	Other indeterminate forms
9.3	Improper Integrals: Infinite Limits of Integration
9.4	Improper Integrals: Infinite Integrands

Course Coordinator:
Zbigniew Fiedorowicz
2003-2004

Mathematics 153 **5 cr.** **Calculus and Analytic Geometry**
Au, Wi
**Book change occurred in Spring 2004*

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 with Analytic Geometry by Ellis and Gulick, 5th ed.

Topics & Sample Syllabus

Sections	Topics
	SEQUENCES AND SERIES:
9.1	Polynomial Approximation
9.2	Sequences
9.3	Convergence Properties of Sequences
9.4	Infinite Series
9.5	Positive Series: The Integral Test and the Comparison Tests
9.6	Positive Series: The Ratio Test and the Root Test
9.7	Alternating Series and Absolute Convergence
9.8	Power Series
9.9	Taylor Series
9.10	Binomial Series
	CURVES IN THE PLANE:
10.1	Parametrized Curves
10.2	Length and Surface Area for Parametrized Curves
10.3	Polar Coordinates
10.4	Length and Area in Polar Coordinates
10.5	Conic Sections
	VECTORS, LINES AND PLANES:
11.1	Cartesian Coordinates in Space
11.2	Vectors in Space
11.3	The Dot Product
11.4	The Cross Product and Triple Products
11.5	Lines in Space
11.6	Planes in Space
	VECTOR-VALUED FUNCTIONS:
12.1	Definitions and Examples
12.2	Limits and Continuity of Vector-Valued Functions
12.3	Derivatives and Integrals of Vector-Valued Functions
12.4	Space Curves and Their Lengths
12.5	Tangents and Normals to Curves

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Course Coordinator:
Phil Huneke
2003-2004

Mathematics 153 **5 cr.** **Calculus and Analytic Geometry**
Sp, Su
**Book change occurred in Spring 2004*

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 Varberg, Purcell, and Rigdon, 8th edition.

Topics & Sample Syllabus

Sections	Topics
	INFINITE SERIES:
10.1	Infinite Sequences
10.2	Infinite Series
10.3	Positive Series: The Integral Test
10.4	Positive Series: Other Tests
10.5	Alternating Series, Absolute Convergence, Conditional Convergence
10.6	Power Series
10.7	Operations on Power Series
10.8	Taylor and Maclaurin Series
	CONICS AND POLAR COORDINATES:
12.1	The Parabola
12.2	Ellipses and Hyperbolas
12.3	More on Ellipses and Hyperbolas
12.4	Translation of Axes
12.5	Rotation of Axes
12.6	The Polar Coordinate System
12.7	Graphs of Polar Equations
12.8	Calculus in Polar Coordinates
	GEOMETRY IN THE PLANE, VECTORS
13.1	Plane Curves: Parametric Representation
13.2	Vectors in the Plane: Geometric Approach
13.3	Vectors in the Plane: Algebraic Approach
13.4	Vector-Valued Functions and Curvilinear Motion
13.5	Curvature and Acceleration
	GEOMETRY IN SPACE, VECTORS
14.1	Cartesian Coordinates in Three-Space
14.2	Vectors in Three-Space
14.3	The Cross Product
14.4	Lines and Curves in Three-Space
14.5	Velocity, Acceleration, and Curvature
14.6	Surfaces in Three-Space
14.7	Cylindrical and Spherical Coordinates

Course Coordinator:
Phil Huneke
2003-2004

Mathematics 188 **1 cr.** **Invitation to Actuarial Science**
Sp

Prerequisite:

Mathematics 151, 161, H161, or H190, or permission of instructor.

Catalog Description:

Introduction to some basic ideas of life, health, and property and casualty insurance. Presentations by practicing actuaries on aspects of the actuarial profession.

Purpose of Course:

This course introduces students to some of the ideas of actuarial science and opportunities in the actuarial profession. At least half of the course presentations will be given by practicing actuaries. We hope that this experience will help our students decide on an appropriate major.

Text:

A textbook is not used in this course.

Syllabus:

WEEK 1	Introduction to Actuarial Science. Discussion of the Major Program in Actuarial Science at Ohio State. Opportunities and expectations for careers in actuarial science and related areas.
WEEKS 2-9	Visits by practicing actuaries from local firms who will give overviews of various aspects of the profession; and talks by O.S.U. faculty from mathematics and related fields, such as statistics, risk management, finance, and economics.
WEEK 10	Course summary, student feedback, and discussions.

Grading:

A brief 1-2 page essay or the solution of a computational problem will be required each week.

Course Coordinator:
Bostwick Wyman
2003-2004

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

**Book change occurred in Summer 2004*

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 with Analytic Geometry, (5th ed.), Robert Ellis and Denny Gulick.

Topics & Sample Syllabus

Sections	Topics
	PARTIAL DERIVATIVES
13.1	Functions of Several Variables
13.2	Limits and Continuity
13.3	Partial Derivatives
13.4	Chain Rule
13.5	Directional Derivatives
13.6	The Gradient
13.7	Tangent Plane Approximation and Differentials
13.8	Extreme Values
13.9	Lagrange Multipliers
	MULTIPLE INTEGRALS
14.1	Double Integrals
14.2	Double Integrals in Polar Coordinates
14.3	Surface Area
14.4	Triple Integrals
14.5	Triple Integrals in Cylindrical Coordinates
14.6	Triple Integrals in Spherical Coordinates
14.7	Moments and Centers of Gravity
14.8	Change of Variables in Multiple Integrals
	CALCULUS OF VECTOR FIELDS
15.1	Vector Fields
15.2	Line Integrals
15.3	Fundamental Theorem of Line Integrals
15.4	Green's Theorem

Course Coordinator:
Phil Huneke
2003-2004

Mathematics 254 **5 cr.** **Calculus and Analytic Geometry**
Su

******Book change occurred in Summer 2004*

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 Varberg, Purcell, and Rigdon, 8th edition

Topics & Sample Syllabus

Sections	Topics
	THE DERIVATIVE IN n-SPACE
15.1	Functions of Two or More Variables
15.2	Partial Derivatives
15.3	Limits and Continuity
15.4	Differentiability
15.5	Directional Derivatives and Gradients
15.6	The Chain Rule
15.7	Tangent Planes, Approximations
	THE INTEGRAL IN n-SPACE
16.1	Double Integrals over Rectangles
16.2	Iterated Integrals
16.3	Double Integrals over Nonrectangular Regions
16.4	Double Integrals in Polar Coordinates
16.5	Applications of Double Integrals
16.6	Surface Area
16.7	Triple Integrals (Cartesian and Coordinates)
16.8	Triple Integrals (Cylindrical and Spherical Coordinates)
	VECTOR CALCULUS
17.1	Vector Fields
17.2	Line Integrals
17.3	Independence of Path
17.4	Green's Theorem in the Plane
17.5	Surface Integrals
17.6	Gauss's Divergence Theorem
17.7	Stoke's Theorem

Course Coordinator:
Phil Huneke
2003-2004

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Mathematics 151A Au
Mathematics 152A Wi
Mathematics 153A Sp
Mathematics 254A Au

5 cr. each

Calculus and Analytic Geometry

Prerequisite:

The prerequisites are the same as those for 151, 152, 153, 254; e.g. for 151A 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:

To introduce students to one-variable calculus with an emphasis on understanding fundamental concepts and how to apply them in a variety of different contexts. Examples and problems are taken from diverse fields and use graphical and numerical, as well as analytical methods.

Follow-up Course:

After finishing 151A students should be encouraged to take Math 152A, 153A and 254A. Students should be able to switch between the "A" sequence and the traditional calculus sequence.

Text:

Calculus, Single and Multivariable, Hughes-Hallett, Gleason, et al., 3rd ed.

Topics:

151A: Chapters 1, 2, 3, and 4. Topics include rational, exponential, logarithmic, and trigonometric functions, and the concept, computation and applications of derivatives.

152A: Chapters 5, 6, 7, and 8. Topics include antiderivatives, computation of indefinite and definite integrals, and the concept and applications of integration.

153A: Chapters 9, 10, 12, 13, sections 3.8 and 17.1-17.2, Appendices B and C, cylindrical and spherical coordinates (and 17.3-17.4 if time permits). Topics include approximations and series, functions of several variables, vectors, polar coordinates, and complex numbers.

254A: Chapters 14, 16, (17.3-17.4 if not covered in 153A) 18, 19, and 20. Topics include differentiation and integration of functions of several variables; vector fields; line integrals; and calculus of vector fields.

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THE OHIO STATE UNIVERSITY
231 WEST EIGHTEENTH AVENUE
COLUMBUS, OHIO 43210-1174

Course Coordinator:
Alice Yew
2003-2004

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

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 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 Mathematics courses - 255C, 415C, 513C, and 568C - 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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Course Coordinator:
Tony Nance
2003-2004

Mathematics 161 Au
Mathematics 162 Wi
Mathematics 263 Sp

5 cr. each

Accelerated Calculus with Analytic Geometry

Prerequisite:
Math 162--- 161 or written permission of department.
Math 263--- 162 or written permission of department.

Catalog Descriptions:

161: Derivatives and their applications, integrals and their applications, for real-valued functions of one variable.

162: Infinite sequences and series, polynomial approximation of functions and Taylor series expansion of functions; vector algebra and geometry with application to space curves and lines and planes in 3-space.

263: Partial derivatives and their applications, multiple integrals and their applications, for real-valued functions of several variables; line and surface integrals.

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, possibly H520.

Text:

Calculus (8th edition); Varberg, Purcell, Rigdon.

NOTE: The textbook for the Math 161 sequence and Math 151 sequence is the same. The text for the H161 sequence is different.

Topics:

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.

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

263 - Surfaces, cylindrical and spherical coordinates, partial derivatives, multiple integrals, line integrals, vector fields, Green's and Stoke's Theorems.

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Course Coordinator:
Henry Glover

2003-2004

Math 161 G	**Au**	**5 cr.**	**Accelerated Calculus with**
Math 162 G	**Wi**		**Analytic Geometry I, II, III**
Math 263 G	**Sp**		

Prerequisite:

Students are individually chosen by the College of Engineering
Math 161G---Course code L placement and high school calculus.
Math 162G---161G or written permission of department.
Math 263G---162G or written permission of department.

Catalog Description:

161G:
Functions, limits and continuity, derivatives, applications of the derivative, the integral, inverse functions, techniques of integration; improper integrals; applications of the integral.

162G: Polynomial approximations and Taylor's Theorem; infinite sequences and series; tests for convergence; vectors, lines and planes.

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

Purpose:

These classes are part of the College of Engineering's Honors (FEH) Program, (previously known as the Gateway Program), in which selected students study core topics for the engineering curriculum in an integrated format.

Text:

Calculus, (8th ed.), D. Varberg, E. J. Purcell and S.E. Rigdon.

Topics:

Generally, the first quarter does the equivalent of 151 and 152. Generally, the second quarter covers153; and the third quarter covers 254, and some additional topics.

Course Coordinator:
Nela Lakos
2003-2004

Mathematics H161 Au
Mathematics H162 Wi
Mathematics H263 Sp

5 cr.

Accelerated Calculus with Analytic Geometry

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.

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.

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

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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Course Coordinator:
V. Bergelson
2003-2004

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

Prerequisite:

Permission of Department.

Catalog Description:

An advanced enrichment course for interested and capable students.

Purpose of Course:

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

Topics:

Interesting special problems as chosen by the instructor.

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Course Coordinator:
V. Bergelson (Honors)
2003-2004

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

Prerequisite:

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

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.

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 vary, for example:

Calculus, Spivak, 3rd. ed -for H190, H191.
Vector Calculus, 4th edition, Marsden/Tromba- for H264 (used in Spring '00 and Spring '03)
Advanced Calculus of Several Variables, Edwards, Jr. – for H264 (used in Spring '01)
Advanced Calculus, 3rd edition, Buck - for H264 (used in Spring '02)

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.

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Course Coordinator:
V. Bergelson
2003-2004

Mathematics 255 **Au, Wi, Sp, Su** **5 cr.** **Differential Equations**
Mathematics 255C **Au, Wi, Sp** **and Their Applications**

Prerequisite:
Mathematics 254. Not open to students with credit for 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 (7th edition, red cover, custom version), Boyce and DiPrima. (Math 255).

Differential Equations & Mathematica, Davis (255C).

Topics & Sample Syllabus

Sections	Topics	Approximate Time
	Introduction	
1.1	Some Basic Mathematical Models; Direction Fields	2 lectures
1.2	Solutions of Some Differential Equations	
1.3	Classification of Differential Equations	
2.2	Separable Equations	
	First Order Differential Equations	
2.1	Linear Equations with Variable Coefficients	6 lectures
2.4	Differences Between Linear and Nonlinear Equations	
2.5	Autonomous Equations and Population Dynamics	
2.6	Exact Equations and Integrating Factors	
2.7	Numerical Approximations: Euler's Method	
2.8	The Existence and Uniqueness Theorem	
	Second Order Linear Equations	
3.1	Homogeneous Equations with Constant Coefficients	5 lectures
3.2	Fundamental Solutions of Linear Homogeneous Equations	
3.3	Linear Independence and the Wronskian	
3.4	Complex Roots of the Characteristic Equation	
3.5	Repeated Roots; Reduction of Order	
3.6	Nonhomogeneous Equations; Method of Undetermined Coefficients	
3.7	Variation of Parameters	

MIDTERM #1

(Topics Cont'd)

Topics & Sample Syllabus, cont'd

	Higher Order Linear Equations	
4.1	General Theory of *n*th Order Linear Equations	6 lectures
4.2	Homogeneous Equations with Constant Coefficients	
4.3	The Method of Undetermined Coefficients	
4.4	The Method of Variation of Parameters	
	Series Solutions of Second Order Linear Equations	
5.1	Review of Power Series	6 lectures
5.2	Series Solutions near an Ordinary Point, Part I	
5.3	Series Solutions near an Ordinary Point, Part II	
5.4	Regular Singular Points	
5.5	Euler Equations	
5.6	Series Solutions near a Regular Singular Point, Part I	
5.7	Series Solutions near a Regular Singular Point, Part II	
	MIDTERM #2	
	The Laplace Transform	
6.1	Definition of the Laplace Transform	5 lectures
6.2	Solution of Initial Value Problems	
6.3	Step Functions	
6.4	Differential Equations with Discontinuous Forcing Functions	
6.5	Impulse Functions	
6.6	The Convolution Integral	

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Course Coordinator:
Yuval Flicker
2003-2004

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

Prerequisite:

Mathematics 254.

Catalog Description:

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

Purpose of Course:

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

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

Text:

The Fundamentals of Higher Mathematics, Falkner

Other useful references:

Theory and Problems of Set Theory and Related Topics (Schaum's Outline), Lipschutz.
How to Read and Do Proofs, Solow.
The Foundations of Mathematics, Stewart and Tall.

Course Coordinator:
Neil Falkner
2003-2004

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 presents math in rigorous form and requires students to deal with abstract systems and mathematical proofs.

Follow-up Course:

Math 566.

Text:

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

(Over for Topics List)

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Topics List & Sample Syllabus:

Sections	Topics
	THE LOGIC OF COMPOUND SETS
1.1	Logical Form and Logical consequence
1.2	Conditional Statements
1.3	Valid and Invalid Arguments
1.4	Application: Digital Logic Circuits
	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
	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
	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
	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
	RELATIONS
10.1	Relations on Sets
	FUNCTIONS
7.1	Functions Defined on General Sets
7.3	One-to-One and Onto, Inverse Functions
7.5	Composition of Functions

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Course Coordinator:
Timothy Carlson
2003-2004

Mathematics 414 **3 cr.** **Group Studies: Differential Equations**
SP **for Engineering Applications**

(Prior to Spring 2001, this course was offered as 694D.)

Prerequisite:

To be taken concurrently with Aero-Eng 441 or permission from instructor.

Catalog Description:

Introduction to the basic methods for solving ordinary and partial differential equations, and some applications.

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 414, 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, 7th edition, Boyce and DiPrima.

(Over for Topics List & Sample Syllabus)

Topics List & Sample Syllabus:

Sections	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

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Course Coordinator:
George Majda
2003-2004

Mathematics 415 Au, Wi, Sp, Su
Mathematics 415C Au, Wi, Sp

4 cr.

Ordinary and Partial Differential Equations

Prerequisite:
Mathematics 254

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

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

Text:
*Elementary Differential Equations and Boundary Value Problems, (7th edition, custom version), Boyce and DiPrima. (415)

Differential Equations & Mathematica, Davis (415C)

Topics:

1.1-1.3	Introduction to differential equations, including some applications for motivation
2.1	Linear first order ordinary differential equations (ODEs) and integrating factors
2.2	Separable equations
2.3	Applications of linear equations
2.4	Bernoulli's equation: Differences between linear and nonlinear equations
2.5	Qualitative theory for solving nonlinear ODEs
2.6	Exact equations
3.1	Homogeneous equations with constant coefficients
3.2, 3.3	Fundamental solutions, linear independence, Wronskian
3.4	Complex numbers and complex roots of the characteristic polynomial
3.5	Repeated real roots of the characteristic equation and the method of reduction order
3.6	Nonhomogeneous equations: method of undetermined coefficients
3.7	Nonhomogeneous equations: method of variation of parameters
3.8, 3.9	Vibrations with and without damping and forcing
5.1	Review of power series
5.2	Examples of series solutions near regular points
10.1	Two-point boundary value problems
10.2, 10.3	Fourier series, Fourier convergence theorem
10.4	Fourier series for even and odd functions
10.5	Heat equation with zero boundary conditions
10.6	Heat equation with other boundary conditions
10.7	Wave equation and D'Llembert's solution
10.8	Laplace's equation

Course Coordinator:
George Majda
2003-2004

*7th edition, custom version; purple cover used for Autumn 2003
*7th edition, custom version; red cover used for Winter, Spring, Summer 2004

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

Prerequisite:

Permission of Department.

Catalog Description:

An advanced enrichment course for interested and capable students.

Purpose of Course:

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

Topics:

Interesting special problems as chosen by the instructor.

Course Coordinator:
V. Bergelson (Honors)
2003-2004

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) This course fulfills the spirit of the 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:

A History of Mathematics, Carl B. Boyer and Uta Merzbach
Mathematics and its History, Stillwell
A History of Mathematics - An Introduction, Victor J. Katz (2nd ed.)
Fermat's Enigma, S. Singh

Topics:

The topics will vary based on the instructors.

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Course Coordinator:
Bostwick Wyman
2003-2004

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

Prerequisite:

Mathematics 345 or GRAD standing

Catalog Description:

Advanced topics from Euclidean Geometry.

Purpose of Course:

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

Text:

Math 507 course packet

Optional Reference:

Clemens & Clemens, Geometry for the Classroom, Springer Verlag.

Greenberg, Euclidean & Non-Euclidean Geometries, W.H. Freeman & Co.

Topics:

I. Review of Euclidean geometry (resurrect high school geometry as the unique complete, flat, 2-dimensional geometry)
II. Intuitive idea of Riemannian geometry (consider 2-dimensional geometries which are 'curved')
III. Hyperbolic geometry (a negatively curved, complete homogeneous, 2-dimensional geometry)
III. Rigid motions in 2-dimensional geometries (enough of these is what makes the geometry 'homogeneous')
IV. Transformations, linear algebra, linear fractional transformations
V. Spherical geometry (a positively curved, complete homogeneous, 2-dimensional geometry)
VI. Return to Riemannian geometry (curved geometries of various dimensions)

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Course Coordinator:
Herb Clemens
2003-2004

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

Prerequisite:

Mathematics 255 or 415 or 556.

Catalog Description:

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

Purpose of Course:

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

Text:

Advanced Engineering Mathematics, 8th ed., Kreyszig. Selected chapters for use in the Department of Mathematics, Ohio State University.

Topics List & Sample Syllabus

Sections	Topics	Approximate Time
10.1-10.4	Fourier Series	8 days*
10.6	Forced Oscillations	
10.7 (optional)	Approximation by trigonometric polynomials	
11.1, 11.3-11.5	Partial Differential Equations**	8 days*
11.8 (optional)	Rectangular Membrane: Use of Double Fourier Series	
11.9 (optional)	Laplacian in Polar Coordinates	
5.1-5.8	Laplace Transform	9 days*
If time permits:		
11.13	Application of Laplace Transform to PDE's (or other applications).	3 days

*Including a test

**Only rectangular coordinates are required. The Kreyszig 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 considerably augmented with examples from other texts.

Course Coordinator:
George Majda
2003-2004

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

Prerequisite:

Mathematics 254

Catalog Description:

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

Purpose of Course:

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

Text:
Introduction to Vector Analysis, Davis and Snider, 7th edition

Possible Alternative Texts:
Advanced Engineering Mathematics, Kreyszig, 8th edition
Div, Grad, Curl and All That, Schey; and Schaum's outline Vector Analysis

Topics & Sample Syllabus

Sections	Topics	Approximate Time
1.1-1.12, 1.14	Review vector algebra, geometry, Dot and cross products, lines and planes	4 days
2.1-2.3 (2.4 optional)	Vector functions of one variable, arc length, Velocity, acceleration, curvature	5 days
3.1-3.6	Vector and scalar functions, Chain Rule, Divergence, gradient and curl, directional derivative, normals, tangent planes	4 days
4.1-4.4, 4.6-4.9,	Line integrals, potentials, surfaces, surface integrals, Green's Theorem, the Divergence Theorem, Stoke's Theorem, potentials, Applications	13 days

Additional Topics (Instructor's Choice) Time Permitting:
This syllabus is based on the Davis and Snider text. This book is well-written but very verbose. It does not include any applied science applications from fluid mechanics or electricity and magnetism, for example.

(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))

Each class should include some applied examples obtained from other textbooks.

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Course Coordinator:
George Majda
2003-2004

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, Brown/Churchill, 6th edition

Possible Alternative Text:
Advanced Engineering Math, Kreyszig, 8th 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:

Topics	**Approximate Time** (days)
Complex numbers, polar form	3
Analyticity, Cauchy-Riemann equations	3
Elementary functions	4
TEST	
Mapping by elementary functions	3
Cauchy integral theorem and consequences	5
TEST	
Power series	3
Residues, definite integrals	6

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

Topics	**Approximate Time** (days)
Complex analytic functions	9
Complex integrals	5
Power Series, Taylor and Laurent Series	4
Integration by residues	6
Conformal Mapping (omit 16.5)	4
Complex functions and potential theory: (if time permits and prior material is grasped)	

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THE OHIO STATE UNIVERSITY
231 WEST EIGHTEENTH AVENUE
COLUMBUS, OHIO 43210-1174

Course Coordinator:
George Majda
2003-2004

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

Prerequisites:

H520-H263 or H264 with a grade of C or better, or written permission of Honors Committee chairperson.

H521-H520 with a grade of C or better or written permission of Honors Committee chairperson.

H522-H521 with a grade of C or better or written permission of Honors Committee chairperson.

Catalog Descriptions:

H520: Vector spaces, linear transformations, systems of equations, determinants, eigenvalues, spectral theorem, Cayley-Hamilton theorem.

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.

H522: Analytic functions, Cauchy integral theory, residue calculus, series representations, conformal mapping.

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:

Autumn: H520
Valenza, Linear Algebra: An Introduction to Abstract Mathematics (1998)
Dettman, Introduction to Linear Algebra and Differential Equations (1999)
Strang, Linear Algebra and Its Applications (2000)
Axler, Linear Algebra Done Right (2001)
Curtis, Linear Algebra: An Introductory Approach (used in 2003)

Winter: H521
Dettman, Introduction to Linear Algebra and Differential Equations (2000)
Strogatz, Nonlinear Dynamics and Chaos (2001)
Coddington, An Introduction to Ordinary Differential Equations (1999, 2002, 2003)

Spring: H522
Flanigan, Complex Variables: Harmonic and Analytic Functions (used in Spring '99)
Bak-Newman, Complex Analysis, 2nd edition (used in Spring '01)
Silverman, Complex Analysis with Applications, (used in Spring 2003)

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Course Coordinator:
V. Bergelson
2003-2004

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

Prerequisite:

Mathematics 254.

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.

Text:

Probability, Jim Pitman.

Topics:

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

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Course Coordinator:
Neil Falkner
2003-2004

Mathematics 532 **3 cr.** **Mathematical Foundations**
Sp **of Actuarial Science**

Prerequisite:

Mathematics 530 or Statistics 520, or permission of instructor.

Catalog Description:

Problem Workshop for applications of calculus and probability to risk management.

Purpose of Course:

To introduce students to the syllabus for the Society of Actuaries/Casualty Actuarial Society Examination 1. The course will contain a quick review of ideas from calculus and probability, an introduction to the ideas of risk management needed for the examination, and extensive problem solving. Most students will sit for Exam 1 in May.

Text:

Actex One-Pack, review manual for Exam 1.

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Course Coordinator:
Bodtwick Wyman
2003-2004

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

*** Offered in odd years only (Wi 2003, Wi 2005, etc.)**

Prerequisite

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

Catalog Description

The topology of E^n, differentiation of vector valued functions, inverse and implicit function theorems, Riemann and Lesbegue 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

Differential Geometry of Curves and Surfaces, Docarmo, (or similar level text)

Topics

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.

Course Coordinator:
V. Bergelson
2003-2004

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

*** Offered in odd years only (Sp 2003, Sp 2005, etc.)**

Prerequisite

Mathematics H540, or permission of the instructor

Catalog Description

Curves and line integrals in E^n, tensor and exterior algebras, differential forms, integration on manifolds, divergence and Stokes' theorem and applications.

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

Differential Geometry of Curves and Surfaces, Docarmo, (or similar text)

Topics

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.

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Course Coordinator:
V. Bergelson
2003-2004

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

Prerequisite:

Mathematics 345 or equivalent

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 and inequalities.

Follow-up Course:

Math 548.

Text:

Introduction to Real Analysis, 3rd ed., Bartle/Sherbert

Topics:

1. Monotone functions. Monotone sequences.
2. Boundedness. Estimations.
3. Definition of the limit of a sequence. Limit rules. Standard examples.
4. Principle of nested intervals. The Bolzano-Weierstrass Theorem. The Cauchy Criterion. Supremum and infimum.
5. Infinite series. Comparison tests. Ratio and root tests. Integral test. Absolute convergence.

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Course Coordinator:
Paul Nevai
2003-2004

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

Text:

Introduction to Real Analysis, 3rd ed., Bartle/Sherbert

Topics:

1. Conditionally convergent series. Alternating series. Rearrangements.
2. Power series.
3. Continuous functions.
4. Limits of functions.
5. Uniform continuity.
6. Definition of the derivative. Differentiation rules.
7. Mean-Value Theorem.
8. L'Hospital's Rules.
9. Convexity.

Course Coordinator
Paul Nevai
2003-2004

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

Prerequisite:

Mathematics 548.

Catalog Description:

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

Purpose of Course:

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

Text:

Introduction to Real Analysis, 3rd ed., Bartle/Sherbert

Topics:

1. Taylor's Theorem.
2. Definition of the Riemann integral. A piecewise continuous function is Riemann integrable. Properties of the integral.
3. Fundamental Theorem of Calculus. Integration by parts and change of variable.
4. Exponential and logarithmic function.
5. Improper integrals.
6. Functional sequences and series.
7. Uniform convergence.
8. Power series and analytic functions.

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Course Coordinator:
Paul Nevai
2003-2004

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

Prerequisite:

Mathematics 254

Catalog Description:

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

Purpose of Course:

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

Text:

Vector Calculus, Thomas H. Barr

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:

Review of vectors (dot product, cross product), curves, gradient, curl, divergence, line integrals, surface integrals, the Divergence Theorem, Green's Theorem, Stoke's Theorem and applications of these theorems.

Any selection of topics made by the instructor should aim to leave enough time in the end to cover the divergence theorem and Stoke's theorem.

Sections	Topics	Approximate Time
1.1-1.7 (1.2-1.3 optional) 1.8-1.9	Review of vectors (dot product and cross product), lines and planes Vector valued functions, derivatives	2 weeks
3.7 3.8	Gradient Divergence and curl	2 weeks
4.1, 4.2, 4.5, 4.6 5.1-5.4	Arc length, line integrals, surface area, integrals Conservative vector fields, Green's Theorem, Divergence Theorem, Stoke's Theorem	6 weeks

Section 4.6 introduces notation of differential forms but it doesn't really go into the topic of differential forms. Other possible topics that could be included are the topics of Curvilinear coordinates: curl and divergence in spherical and cylindrical coordinates (for example, from the book Vector Analysis, Davis/Snyder, Section 3.10).

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Course Coordinator:
Luis Casian
2003-2004

Mathematics 552 **5 cr.** **Introduction to the Theory of**
Su **Functions of a Complex Variable**

Prerequisite:

Mathematics 254

Catalog Description:

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

Purpose of Course:

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

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Course Coordinator:
Luis Casian
2003-2004

Mathematics 566 3 cr. **Discrete Mathematical Structures II**
A, W, Sp, Su (2nd Term)

Prerequisite:

Mathematics 366.

Catalog Description:

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

Purpose of Course:

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

Text:

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

Topics and Sample Syllabus

Sections	Topics
	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
6.5	R-Combinations with Repetition Allowed
6.7	The Binomial Theorem
	RECURSION
8.1	Recursively Defined Sequences
8.2	Solving Recurrence Relations by Iteration
8.3	Second-Order Homogeneous Recurrence Relations with Constant Coefficients
8.4	General Recursive Definitions
	O-NOTATION AND THE EFFICIENCY OF ALGORITHMS
9.1	Real-Valued Functions of a Real Variable and Their Graphs
9.2	O-Notation
	RELATIONS
10.1	Relations on Sets
10.2	Reflexivity, Symmetry, and Transitivity
10.3	Equivalence Relations
10.5	Partial Order Relations
	GRAPHS AND TREES
11.1	Graphs: An Introduction
11.2	Paths and Circuits
11.3	Matrix Representations of Graphs
11.4	Isomorphisms of Graphs
11.5	Trees
11.6	Spanning Trees

Course Coordinator:
Timothy Carlson
2003-2004

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

Prerequisite:
Mathematics 254. Not open to students with credit for 571.

Catalog Description:
The space R^n and its subspaces; matrices as mappings; matrix algebra; systems of equations; determinants; dot product in 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 R^n. Emphasis is on techniques, computational skills, and fundamental concepts.

Follow-up Course:
575, 578, or 580. Math 569 was last offered Winter 1998 and is not projected to run in the foreseeable future.

Text:
Linear Algebra and its Applications, Lay, Addison-Wesley, 3rd edition.

Topics and Sample Syllabus

Sections	Topics
LINEAR EQUATIONS IN LINEAR ALGEBRA	
1.1	Systems of Linear Equations
1.2	Row Reduction and Echelon Forms
1.3	Vector Equations
1.4	The Matrix Equation
1.5	Solution Sets of Linear Systems
1.7	Linear Independence
1.8	Introduction to Linear Transformations
1.9	The Matrix of a Linear Transformation
MATRIX ALGEBRA	
2.1	Matrix Operations
2.2	The Inverse of a Matrix
2.3	Characterizations of Invertible Matrices
2.8	Subspaces of R^n
2.9	Dimension and Rank
DETERMINANTS	
3.1	Introduction to Determinants
3.2	Properties of Determinants
3.3	Cramer's Rule, Volume, and Linear Transformations
EIGENVALUES AND EIGENVECTORS	
5.1	Eigenvectors and Eigenvalues
5.2	The Characteristic Equation
5.3	Diagonalization
ORTHOGONALITY AND LEAST SQUARES	
6.1	Inner Product, Length, and Orthogonality
6.2	Orthogonal Sets
6.3	Orthogonal Projections
6.4	The Gram-Schmidt Process
6.5	Least-Square Problems

Course Coordinator:
Harry Allen
2003-2004

Mathematics 571 **3 cr.** **Linear Algebra for Applications I**
A, Wi, 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:

Linear Algebra Labs with Matlab, Hill & Zitarelli, 2nd edition
Linear Algebra with Applications, S. Leon, 5th edition

Topics List:

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

Leon:

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

Course Coordinator:
Ed Overman
2003-2004

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

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 Labs with Matlab, Hill & Zitarelli, 2nd edition
Linear Algebra with Applications, S. Leon, 5th edition

Topics List:

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

Leon:

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

Course Coordinator:
Ed Overman
2003-2004

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Mathematics 573 **5 cr.** **Elementary Number Theory**
Sp*

*Offered in odd years only (Sp 2003, Sp 2005, etc.)

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 integers; 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
2003-2004

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 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:

Introductory Combinatorics, (3rd ed.), Richard A. Brualdi

Topics List:

Fundamental counting principles, combinatorial identities, binomial and multinomial coefficients, partitions of integers and sets, Stirling numbers, principle of inclusion-exculsion, the pigeonhole principle, graphs, edge- and vertex- colorings, chromatic polynomials, matchings, latin squares, orthonality of latin squares, finite projective planes, block designs, symmetric block designs, Hadamard matrices.

(Over for Topics List)

Topics List

What is Combinatorics?
Examples include perfect covers of chessboards, magic squares, the 4-color problem, 36-officers problem, shortest route problem

Permutations and Combinations
Two basic counting principles, permutations and combinations of sets, permutations and combinations of multisets

The Binomial Coefficients
Pascal's formula, the binomial theorem, identities, the multinomial theorem, Newton's binomial theorem

Matchings in Bipartite Graphs
General problem formulation, matchings , systems of distinct representatives

Introduction to Graph Theory
Basic properties, Eulerian trails, Hamilton chains and cycles, bipartite multigraphs, trees

More on Graph Theory
Chromatic number, plane and planar graphs, 5-color theorem

Recurrence Relations & Generating Functions
Some number sequences, linear homogeneous recurrence relations, non-homogeneous recurrence relations, generating functions, recurrences and generating functions, exponential generating functions

Special Counting Sequences
Difference sequences and Stirling numbers, partition numbers

Combinatorial Designs
Block designs, steiner triple system, latin squares

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Course Coordinator:
Thomas Dowling
2003-2004

Mathematics **H576 Wi*** **5 cr. each** **Number Theory**
H577 Sp* **Through History I, II**

***Offered only in the Winter quarter of even years**
***Offered only in the Spring quarter of even years**

Prerequisite:

H576: H190, H191, and H520, or permission of the department.
H577: H576 or permission of the department.

Catalog Description:

H576:
The integrated honors sequence H576-H577 includes elementary analytic and algebraic number theory and traces its unifying role in development of mathematics through history.

H577:
Continuation of H576.

Purpose of Course:

The intention of this sequence is to present number theory, the "Queen of Mathematics" through its historical development. Being one of the oldest mathematical disciplines, number theory, in the course of its history, both benefited from and contributed to such major mathematical areas as geometry, algebra and analysis. These courses will be especially beneficial for honor students planning to pursue careers in mathematics, physics, computer science and education, but may be of interest to engineering students as well.

Texts vary, for example:

An Introduction to the Theory of Numbers, G. Hardy and E. Wright
A Course in Number Theory, (2nd edition), H. Rose
A Friendly Introduction to Number Theory, Silverman
An Introduction to the Theory of Numbers, I. Niven, H.S. Zukkerman, H.L. Montgomery

(over for Suggested Topics List)

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Suggested Topics List

H576:

1. Review of Egyptian and Mesopotamian Mathematics. Greek tradition. Three classical Greek problems (cube doubling, angle trisection, circle quadrature).

2. Famous irrationalities.

3. Continued fractions and applications thereof (quadratic surds, Pell's equation, diophantine approximations, etc.)

4. More on diophantine approximation. Algebraic numbers. Liouville numbers. A glimpse into the Thue-Siegel-Roth Theorem.

5. Uniform distribution modulo one. Weyl criterion. Some important sequences. Pisot-Vijayaraghavan numbers. Formulation and discussion of Margulis' solution of Oppenheimer's conjecture.

6. Normal numbers. Champerwoun's example. Almost every number is normal. Levy-Khinchine Theorem on normality of continued fractions.

H577:

1. Infinitude of primes. Euler's identity. Chebyshev's Theorem. Bertraud's Postulate. Dirichlet's Theorem on primes in progressions. Average rate of growth of classical number-theoretical functions.

2. Finite fields. Wedderburn's Theorem. Applications: Latin Squares and Cryptography.

3. Quadratic reciprocity.

4. Pythagorean triangles. Representation of integers as sums of squares. Quaternions, Caley's octavas. Hurwitz' Theorem. Minkowsky's geometry of numbers.

5. p – adic numbers, their construction and axiomatic characterization (Ostrowski's Theorem). Minkowski-Hasse principle.

6. Fermat's last theorem. Some easy cases. A glimpse into modern developments (elliptic curves, Mordell-Weil Theorem, etc.).

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Course Coordinator:
Vitaly Bergelson
2003-2004

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

Prerequisite:

CIS 221, and Mathematics 568, and either Mathematics 530 or Statistics 427.

Catalog Description:

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

Purpose of Course:

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

Text:

Discrete Dynamical Systems, Sandefur

Other References:

Discrete Mathematics, Norman L. Biggs; 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.

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Course Coordinator:
D. Ray-Chaudhuri
2003-2004

Mathematics	**580 Au, Wi** **581 Wi, Sp** **582 Sp, Au**	**3 cr. each**	**Algebra I** **Algebra II** **Algebra III**

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

Topics:

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

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

582: Three-dimensional groups of motions. Some linear algebra. Elements of Galois Theory.

Course Coordinator:
Ron Solomon
2003-2004

Mathematics 588 **4 cr.** **Practicum in Actuarial Science**
Sp

Prerequisite:

3rd year standing and completion of second writing course. Open only to actuarial science majors.

Catalog Description:

Presentations by practicing actuaries on topics drawn from their fields of expertise; oral presentations by students on selected topics in actuarial science.

Purpose of Course:

To introduce students to actuarial practice and hone their communication skills. We expect that this course will serve as the third writing course for the actuarial science major.

Text:

There is no text for this course.

Topics:

Various topics in life, health, and property and casualty insurance, pension and benefits consulting, chosen by the visitors.

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Course Coordinator:
Bostwick Wyman
2003-2004

Mathematics	**H590 Au** **H591 Wi** **H592 Sp**	**5 cr. each**	**Algebraic Structures I** **Algebraic Structures II** **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:

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 vary, for example:

Algebra, M. Artin
Abstract Algebra, D. Dummit and R. Foote
Topics in Algebra, I. Herstein

Suggested Topics :

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.

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Course Coordinator:
V. Bergelson
2003-2004

Mathematics 601 **3 cr.** **Mathematical Principles**
Au **in Science I**

Prerequisites:

Several quarters of mathematics at the 400-500 level, including Mathematics 568.

Catalog Description:

Linear algebra in finite dimensions, abstract vector spaces, linear transformations, fundamental subspaces, complex inner product spaces.

Purpose of Course:

To make available an updated advanced-undergraduate/graduate course sequence which accommodates the academic (mathematical) and scheduling needs of client departments as well as those of the mathematics department.

Follow-up Course:

Math 602

Text:

Introduction to Linear Algebra, Johnson, Riess & Arnold, (chapter 4)
Linear Algebra and its Applications, Strang, (chapter 5)

Website: http://www.math.ohio-state.edu/~gerlach/math

(Over for Topics List)

Topics List

I. VECTOR SPACES (approximately 10 days*)

- Axiomatic properties
- Subspaces
- Spanning sets
- Linear independence
- Bases and coordinates
- Dimension
- Linear functionals and covectors
- Dual of a vector space
- Bilinear functionals
- Metric
- Isomorphism between vector space and its dual

II. LINEAR TRANSFORMATIONS (approximately 10 days)

- Null space, range space
- Dimension Theorem, Implicit Function Theorem for a linear system
- Classification of linear transformations
- Invertible transformations
- Existence and uniqueness of a system of equations
- Algebraic operations with linear transformations
- The Representation Theorem
- Change of basis, change of representation, and the transition matrix
- Invariant subspaces, commuting operators and eigenvectors

III. INNER PRODUCT SPACES (approximately 5 days)

- Inner products
- Orthogonormal bases
- Gram-Schmidt orthogonalization process
- Orthogonal matrices
- Right and left inverses
- Least squares approximation, Bessel's inequality, normal equations
- The four fundamental subspaces of a matrix
- The Fredholm alternative, uniqueness=existence
- Intersection and sum of two vector space

IV. EIGENVALUES AND EIGENVECTORS (approximately 5 days)

- Eigenvector basis
- Diagonalizing a matrix
- Generalized eigenvectors
- Phase portrait of a system of linear differential equations
- Powers of a matrix
- Markov processes
- Adjoint of an operator

(1 day = one 48 min. lecture)*

Course Coordinator:
Ulrich Gerlach
2003-2004

Mathematics 602 **3 cr.** **Mathematical Principles in Science II**
Wi

Prerequisite:

Mathematics 601

Catalog Description:

Eigenvalue and eigenvector analysis in finite dimensions, quadratic forms, singular value decomposition, linear analysis in infinite dimensions, Sturm-Liouville Theory, Hilbert spaces.

Purpose of Course:

To make available an updated advanced-undergraduate/graduate course sequence which accommodates the academic (mathematical) and scheduling needs of client departments as well as those of the mathematics department.

Follow-up Course:

Math 603

Possible Texts and Topics:

I. Eigenvalues and eigenvectors:

Linear Algebra and its Applications, Strang, (Ch. 5, 6, and Appendix A)

II. Infinite-dimensional vector spaces:

III. 1. Linear Mathematics in Infinite Dimensions, U. Gerlach, (Ch. 1 and 3)
2. a) Fourier Series and Boundary Value Problems, Churchill and Brown, (Ch. 3)
b) Mathematical Methods in Physics and Engineering, Dettman, (Ch. 2)

IV. **Website: http://www.math.ohio-state.edu/~gerlach/math**

(over for Topics List)

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Topics List

I. EIGENVALUES AND EIGENVECTORS
(approximately 20 days)*

- Hermetian operators
- Spectral Theorem
- Triangularization via unitary similarity transformation
- Diagonalization of normal matrices
- Positive definite matrices
- Quadratic forms and the generalized eigenvalue problem
- Extremization with linear constraints
- Rayleigh quotient
- Singular value decomposition of a rectangular matrix
- Pseudo-inverse of a rectangular matrix

II. INFINITE DIMENSIONAL VECTOR SPACES: EXAMPLES
(II & III approximately 10 days)

- Sturm-Liouville systems: regular, periodic, and singular
- Sturm-Liouville series

III. INFINITE DIMENSIONAL VECTOR SPACES: PRINCIPLES

- Inner product spaces
- Complete metric spaces
- Hilbert spaces
  - Square summable series and square integrable functions
- Least squares approximation
  - Projection theorem
  - Generalized Fourier coefficients
- Bessel's inequality, Parceval's equality and completeness
- Unitary transformation between Hilbert spaces

*(*1 day = one 48 min. lecture)*

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Course Coordinator:
Ulrich Gerlach
2003-2004

Mathematics 603.02 **3 cr.** **Mathematical Principles**
Sp **in Science III**

Prerequisite:

Some complex analysis. Mathematics 514 would be sufficient.

Catalog Description:

An introduction to partial differential equations (pdes) that arise in the mathematical and engineering sciences.

Purpose of Course:

To make available an updated advanced-undergraduate/graduate course sequence which accommodates the academic (mathematical) and scheduling needs of client departments as well as those of the mathematics department.

Text:

Linear Mathematics in Infinite Dimensions, Gerlach (Ch. 2, 4, 5)

I. Fourier Theory:
   Fourier Series and Boundary Value Problems, Churchill and Brown, (Ch. 4, 5, 7)
II. Green's Function Theory:
   Principles of Applied Mathematics, Friedman, (Ch. 3-5)
III. Theory of solutions to pdes in 2 and 3 dimensions:
   Partial Differential Equations in Physics, Sommerfeld, (Ch. IV, II)
   Mathematical Methods of Physics, Mathews and Walker, (Ch. 8)

IV. **Website: http://www.math.ohio-state.edu/~gerlach/math**

(over for Topics List)

Topics List

I. FOURIER THEORY
(I & II approximately 20 days)*
- Fourier series
- Dirichelet kernel
- Fourier's Theorem on a finite domain
- Sequences leading to the Dirac delta function
- Fourier transform representation
- Change of basis in Hilbert space:
  - Orthonormal wavelet and wavepacket representations

II. GREEN'S FUNCTION THEORY: INHOMOGENEOUS DIFFERENTIAL EQUATIONS
- Homogeneous systems
- Adjoint systems
- Inhomogeneous systems
- The concept of a Green's function
- Solution via Green's function
- Integral equation of a linear system via its Green's function
- Classification of integral equations
- The Fredholm alternative
- Green's function and the resolvent of the operator of a system
- Eigenfunctions and eigenvalues via residue calculus
- Branches, branch cuts, and Riemann sheets
- Singularity structure of the resolvent of a system:
  - Poles and branch cuts
  - Effect of boundary conditions and domain size

III. THEORY OF SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS IN TWO AND THREE DIMENSIONS
(approximately 10 days)
- Partial differential equations: hyperbolic, parabolic, and elliptic
- The Helmholtz equation and its solutions in the Euclidean plane
  - Geometry of the space of solutions
  - Plane waves vs. cylinder waves:
  - Why, and when to use them
  - Sommerfeld's integral representation
  - Hankel, Bessel, and Neumann waves
  - Change of basis in the space of solutions: partial waves
  - Displaced cylinder waves
  - The Cylindrical Addition Theorem
  - Method of steepest descent and stationary phase
- Analytic behavior of cylinder waves
- Interior (cavity) and exterior (scattering) boundary value problems
- Cauchy problem and characteristics
- Spherical waves: symmetric and nonsymmetric

*(*1 day = one 48 min. lecture)*

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Course Coordinator:
Ulrich Gerlach
2003-2004

Mathematics 618 **3 cr.** **Theory of Interest**
Au

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:

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 Examination 2 of the Society of Actuaries and the Casualty Actuarial Society. 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.

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For further information see:
Bostwick Wyman
2003-2004

Mathematics	**630 Au**	**3 cr.**	**Actuarial Mathematics I**
	631 Wi		**Actuarial Mathematics II**
	632 Sp		**Actuarial Mathematics III**

Prerequisite:

Mathematics 618, and Mathematics 530 or 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: The Mathematics 632 syllabus will be revised to match the topics in Examinations 3 and 4.

Purpose of Courses:

This sequence is designed to introduce students to the mathematical content of the theory of contingencies. The sequence includes some material from the new Examinations 3 and 4 of the Society of Actuaries and the Casualty Actuarial Society. 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.

For further information see:
Bostwiek Wyman,
2003-2004

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

Prerequisite:

Mathematics 547 or permission of the Graduate Advising Committee.

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. This course will help them to become aware of main pitfalls in analysis, to realize the need for a rigorous argument, to gain facility in using Mathematica software for graphical and numerical exploration, and--through a detailed study of well-chosen examples—to develop analytic intuition.

Text:

A Radical Approach to Real Analysis, by David Bressoud

Topics:

Fourier Series
Different Forms of Remainder in Taylor's Formula
Taylor Series (binomial series, $\sin x$, $\cos x$, $\exp x$, $\log(1+x)$, $x/(e^x-1)$, etc.)
The Newton-Raphson Method
Differentiability and Continuity
Hypergeometric Series and Gauss' Convergence Test
Summation by Parts and its Applications
Groupings and Rearrangements. Term by Term Differentiation and Integration.
Bonnet Mean-Value Theorem and Dirichlet-Theorem on Convergence of Fourier Series
Wallis Formula. Bernoulli Numbers and Bernoulli Polynomials. Stirling's Formula.

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Course Coordinator:
To Be Determined
2003-2004

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

Prerequisite:

Permission of Department.

Catalog Description:

651: Real numbers, infinite sequences and series.

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

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

Purpose of Course:

Basic analysis course for mathematics M.S. students, Mathematics Ph.D. students with incomplete prerequisites, and a few others. General work on writing proofs, and on analytic intuition. These courses are meant to prepare 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 Texts:

Introduction to Real Functions and Orthogonal Expansions, B. Sz.-Nagy,
(used 98-99, 99-00, and 00-01)
651: Chapter 1, add. mat.; 652: Chapters 2,3,4; 653: Chapters 5,6 and parts of 7 & 8
[Out of print, but arrangements have been made for the text for the course.]

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

or:
An Introduction to Classical Real Analysis, K. Stromberg, (used 94-95 and 96-97);
651: Chapters 2 and 3; 652: Chapters 4, 5 and 7 (except optional sections); 653: Chapter 6
[Out of print, but may be used for reference]
or:
A First Course in Real Analysis, S. Berberian
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.

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For Further Information see:
Paul Nevai
2003-2004

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

Prerequisite:

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

Catalog Descriptions:

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

(over for topics list and texts)

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Possible Texts:

An Introduction to Algebraic Topology, Rotman
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, 2nd ed., by J. R. Munkres, Prentice-Hall, 1999.

Topics List for Math 655/656/657:

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

Possible Additional Topics:

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

See also: http://www.math.ohio-state.edu/~fiedorow/math655

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Course Coordinator
Zbigniew Fiedorowicz.
2003-2004

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

Prerequisite:

Permission of Department. Reasonable undergraduate algebra background - for example, 568, 580, 581, 582. At least one year (including linear algebra) strongly recommended. Student should feel comfortable with "proofs".

Catalog Descriptions :

670:
Examples of groups, subgroups, quotient groups, isomorphism theorems, group actions, class equation, automorphisms, Sylow theorems, direct products, finitely generated abelian groups, introduction to rings and ring homomorphisms, ideals, quotient rings, Chinese remainder theorem. (Chapters 1-5 and 7 in Dummit/Foote were covered in last two years).

671:
Continuation of 670: Euclidean domains, principal ideal domains, unique factorization domains, polynomial rings, basics of modules over commutative rings (esp. over PIDs), canonical forms for matrices.
(Chapters 8, 9, 10-12 but skip tensor products, exact sequences, tensor, symmetric and exterior algebras)

672:
Continuation of 671: Algebraic extension of fields, ruler and compass constructions, splitting fields, algebraic cosures, cyclotomic polynomials, galois theory for characteristic zero fields, finite fields.

Purpose of Course:

Standard entry course for M.S. students in mathematics. A basic aimis to prepare background for Qualifying Examination in Algebra.

Text:

Abstract Algebra, Dummit & Foote (used 1995, 2002, 2003)
or
Algebra, Artin (used 1992, 1993, 1994)
or
Topics in Algebra, Herstein.

(Over for Topics List and Sample Syllabus)

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Topics List & Sample Syllabus:
(Sample syllabus was based on Dummit/Foote used in 2002 and 2003)

Topics	Approximate Time
670:	
Chapters 1 – 5	8 weeks
Chapter 7	2 weeks
671	
Chapter 8	3 weeks
Chapter 9 (9.1 – 9.5)	2.5 weeks
Chapter 10 (10.1 – 10.4)	
Chapter 11 (11.1 – 11.4)	
Chapter 12	4.5 weeks
672	
Chapter 13 (skip inseparable extensions)	
Chapter 14 (skip transcendental extensions and infinite galois extensions)	

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