Department of Mathematics
The Ohio State University

1983-1984 Mathematics Courses

Course Number	Course Title
50	Introduction to College Mathematics
102	Basic College Mathematics
104	Basic College Mathematics for Science and Engineering
105	Mathematics for Elementary Teachers I
106	Mathematics for Elementary Teachers II
107	Mathematics for Elementary Teachers III
116	Survey of College Algebra
117	Survey of Calculus
130	Elements of Algebra
131	Elements of Calculus I
132	Elements of Calculus II
134	Elements of Calculus III
148	College Algebra
150	Elementary Functions
151	Differential and Integral Calculus
152	Differential and Integral Calculus
151H	Calculus and Analytic Geometry
152H	Calculus and Analytic Geometry
151C	Calculus and Analytic Geometry
152C	Calculus and Analytic Geometry
263H	Calculus
263C	Calculus
153	Differential and Integral Calculus
254	Differential and Integral Calculus
180	Insights into Mathematics
187	Topics in Mathematics
190H	Elementary Analysis
191H	Elementary Analysis
263HX	Elementary Analysis
255	Differential Equations and Their Applications
256	Differential Equations with Applications
290H	Linear Algebra and Multivariable Calculus
291H	Linear Algebra and Multivariable Calculus

Course Number	Course Title
292H	Linear Algebra and Multivariable Calculus
345	Foundations of Higher Mathematics
366	Discrete Mathematical Structures I
415	Ordinary and Partial Differential Equations
416	Vector Analysis and Complex Variables
471	Matrices and Linear Algebra
487H	Advanced Problem Solving
501	Fundamentals of Mathematics I
502	Fundamentals of Mathematics II
503	Fundamentals of Mathematics III
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
530	Probability
531	Probability II
547	Introductory Analysis I
548	Introductory Analysis II
549	Introductory Analysis III
551	Vector Analysis
552	Complex Variables I
556	Differential Equations I
557	Differential Equations II
558	Differential Geometry of Curves and Surfaces
559	Topological Concepts
560	Point-Set Topology
566	Discrete Mathematical Structures II
568	Linear Algebra I
569	Linear Algebra II
573	Elementary Number Theory
574	Geometry
575	Combinatorial Mathematics & Graph Theory
576	Linear Algebra and Discrete Algebraic Structures I
577.01	Linear Algebra and Discrete Algebraic Structures II
577.02	Linear Algebra and Discrete Algebraic Structures III
578	Discrete Mathematical Models
580	Three Quarter Algebraic Sequence
581	Three Quarter Algebraic Sequence
582	Three Quarter Algebraic Sequence

Course Number	Course Title
590H	Algebraic Structures I
591H	Algebraic Structures II
592H	Algebraic Structures III

Mathematics 050 5 cr. Introduction to College Mathematics
A, W, Sp, Su

Prerequisite:

Placement course code T on OSU Math Placement Test or permission of department.

Catalog Description:

Topics will include the arithmetic of fractions and decimals, basic algebra, graphing equations, geometry.

Purpose of Course:

Mathematics 050 is designed to meet the needs of the students entering The Ohio State University with lowest placement. This course will prepare students for 102 or 104.

Audience:

Students are placed in Math 050 only if scores on both the mathematics portion of the ACT and on the OSU Mathematics Placement Test show serious mathematical difficulties. There are also serious difficulties in general scholastic aptitude indicated by low ACT composite scores. The typical student has had at most two years of high school mathematics and there is usually a significant time gap in the student's math training. We assume that all students who take Math 050 will need at least a next mathematics course for their chosen major. An 050 student should go into 102 as a follow-up course unless their chosen major requires 148. The appropriate 050 follow-up course for a student needing 148 is 104.

Follow-up Course:

Math 102 or
Math 104

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Course Syllabus:

1. Review of arithmetic, use of the calculator

2. Fractions, mixed numbers, decimal notation

3. Properties of numbers
   prime factors
   divisibility
   order of operations
   least common multiple
   greatest common divisor

4. Open sentences, solving equations

5. Word problems, percent, geometric formulas

6. The number line, rational numbers

7. Arithmetic of signed numbers, properties of real numbers

8. Integral exponents
   laws of exponents
   simplification of exponential expressions

9. Story problems

10. Solving linear equations and linear inequalities.

11. Applied problems and formulas
    ratio and proportion

12. Scientific notation

13. Graphs of equations
    introduction to ordered pairs
    graphs of polynomial equations

14. Linear equations, slope
    standard form
    slope intercept form
    point-slope form

15. Basic geometric figures and area
    triangles
    polygons

16. Right triangles and Pythagorean Theorem

17. Introduction to functions

18. Extensive use of calculators

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Course Coordinator: Frank Demana
Summer, 1983

Mathematics 102 4 cr. Basic College Mathematics
A, W, Sp, Su

Prerequisite:

Course Code S or Mathematics 050.

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. It prepares students for Math 105, 116, or 130.

Format:

2 lectures, 2 recitations per week except, perhaps, during the Summer Quarter and evening sections.

Audience:

We assume that all students in the course need mathematics as a tool, at least in some science course, and are likely to take more mathematics courses. Many students will have had two or three years of high school math. Many will have had less than two years. In many instances there has been a significant time interval since the student last took a math course.

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Follow-up Courses:

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

Math 105 for elementary education majors.

Math 116 for students in arts and sciences, general agriculture, or social science.

Math 130 for students in the college of administrative science, (except CIS majors).

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Course Syllabus:

1. Review of linear equations, slope
   standard form
   slope intercept form
   point-slope form

2. Systems of equations (two variables)
   Cramer's Rule
   determinants

3. Applications of systems of equations

4. Systems of equations (three variables)

5. Polynomials
   addition and subtraction
   multiplication

6. Factoring
   common monomial factor
   quadratics
   by grouping

7. Solving quadratic equations
   by factoring
   use of quadratic
   by completing the square

8. Variation

9. Simplifying rational expressions
   addition and subtraction
   multiplication and division
   complex fractions

10. Solving fractional equations

11. Fractional exponents

12. Simplifying radical expressions

13. Right triangle trigonometry

14. Inverse trig functions

15. Extensive use of calculators

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Text:

Transition to College Mathematics by F. Demana and J. Leitzel (Addison-Wesley, Publishers).

Computers:

Course Coordinator: Neil Robertson
Summer, 1983

Mathematics 104 — 5 cr. — Basic College Mathematics for Science and Engineering
A, W, Sp, Su

Prerequisite:

Course Code R or S on Math Placement Exam or Mathematics 050 or permission of department.

Exclusion:

Students with credit for 104 cannot enroll in Math 102 for credit. Not open to students with credit in math courses above 108 level, except 180.

Catalog Description:

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

Purpose of Course:

To meet the needs of students entering the University with Math Course Code R or S or with credit for 050 and who need Math 148.

Format:

3 lectures, 2 recitations per week except, perhaps individually taught sections during Summer Quarter and evening and weekend sections.

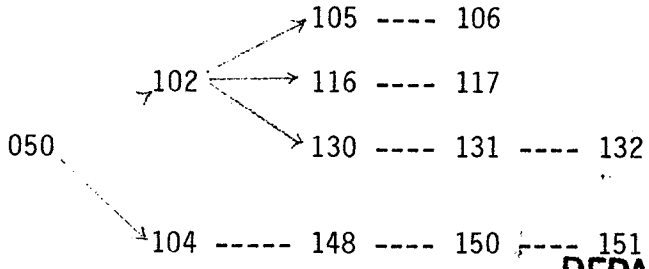
Audience:

We assume that all students in the course need mathematics as a tool and will need mathematics courses (148, 150, 151, etc.). Many students will have had three or four years of high school math.

Follow-up Courses:

Math 148 for students in physical sciences, biological sciences, agricultural sciences, math, engineering or computer science curriculum.

Sequencing Chart:



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Topics List:

1. Review of linear equations and slope -- standard form
   slope intercept form
   point-slope form
2. Systems of equations in two variables -- Cramer's Rule
   determinants
3. Applications of systems of equations
4. Systems of equations in three variables
5. Polynomials -- addition and subtraction
   multiplication and division
6. Factoring -- common monomial factor
   quadratics
   by grouping
7. Solving quadratic equations -- by factoring
   use of quadratic formula
   completing the square
8. Variation
9. Simplifying rational expressions -- addition and subtraction
   multiplication and division
   complex fractions
10. Solving fractional equations
11. Fractional exponents
12. Simplifying radical expressions
13. Additional work with exponents, roots, and radicals
14. Solving linear inequalities
15. Equations and inequalities involving absolute value
16. Functions graphs, and introduction to conics
17. Distance in R^2
18. Graphing linear inequalities
19. Extensive use of calculators

Text:

Phillips, Butts and Shaughnessy: Intermediate Algebra, Applications and Problem Solving, Harper and Row.

Chapters:

1 - 9

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Course Coordinator: B. Waits (Aut. only)
Summer, 1983

Mathematics 105 5 cr. Mathematics for Elementary Teachers I
W, Sp, Su

Prerequisite:

Course Code L, M, N or R or Math 102

Catalog Description:

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

Purpose of Course:

To develop an appreciation of, and basic competency in, the use of analytical thought in the development of a cohesive body of useful mathematical knowledge. Special emphasis on topics encountered in the elementary school mathematics program.

Audience:

Elementary education majors, mainly at the sophomore level. (This course, together with 106, satisfies the mathematics requirements of the certification program for elementary teachers in the State of Ohio.) Students have very wide range of abilities, background, and interests. Many students have a negative view of mathematics. Students on the whole are very hard-working and conscientious.

Follow-up Course:

Math 106

Course Content:

Basic concepts dealing with natural numbers, integers, combinatorial counting procedures, elementary intuitive geometry, linear measurement, area and volume measure, angle measurement.

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Course Coordinators: Jim Schultz
Joe Ferrar

Summer, 1983

Mathematics 106 5 cr. Mathematics for Elementary Teachers II
A, Sp, Su

Prerequisite:

Math 105

Follow-up Course:

Math 107

Course Content:

Rational numbers, decimal representation, elementary probability, geometric constructions, congruence, similarity, real numbers.

Course Coordinators: Joe Ferrar
Jim Schultz

Summer, 1983

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Mathematics 107 5 cr. Mathematics for Elementary Teachers III
Sp

Prerequisite:

Math 106

Catalog Description:

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

Audience:

Same as 105 and 106 but much reduced in number as this is not required for certification. Only the most interested of the 105 and 106 students will enroll.

Course Content:

Optional with instructor. Should closely relate to content of 105 and 106 and serve to tie together topics previously encountered (for example, a study of the group of rigid motions in the coordinatized plane).

Course Coordinators: Joe Ferrar
Jim Schultz

Summer, 1983

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Mathematics 116 5 cr. Survey of College Algebra
A, W, Sp, Su

Prerequisite:

Math 102 or course code L, M, N or R.

Catolog Description:

The sequence 116, 117 treats topics applicable to non-physical sciences. Topics in 116 include college algebra, analytic geometry, linear algebra, and linear programming.

Purpose of Course:

Emphasis is on intuitive understanding. It is hoped that students may feel less intimidated by terminology and symbolism. Primary goal of the sequence is an appreciation of calculus as a great invention of man.

Audience:

Generally apprehensive about mathematics. Backgrounds will vary although most have two years of high school mathematics.

Areas listing 116, 117 as suggested courses include: Agriculture (General and Industrial programs); School of Allied Medical Professions; College of the Arts (Division of Design, Visual Communication); Economics, Psychology, Biological Sciences.

Follow-up Courses:

Students may elect 117 to complete the Arts and Sciences (ASC) 10 hour requirement in category II: Mathematical and Logical Analysis. Alternatively, students in ASC may also elect any course from CIS, Statistics, Philosophy 150, or Math 180 to fulfill the 10 hour requirement of category II.

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Possible Text:

College Mathematics for Management, Life and Social Sciences, 2nd Edition
R. A. Barnett, Dellen Publishing, Co., San Francisco.

Suggested Course Content:

Sections	Topics	Approximate Number of Days
1-1 thru 1-5	Sets, numbers, exponents, radicals, polynomials, fractions	5
1-6 thru 1-8	Linear equations and inequalities, quadratic equations, binomial formula	9
2-1 thru 2-2	Graphs, lines, inequalities	6
2-3 thru 2-4	Relations, functions	5
2-5 thru 2-7	Exponential and logarithmic functions	5
5-1 thru 5-2	Simple and compound interest	2
3-1 thru 3-6	Linear systems, matrices	10
4-1 thru 4-3	Linear inequalities, linear programming	5

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Course Coordinator: Jack Tull
Summer, 1983

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

Prerequisite:

Math 116

Catalog Description:

An introduction to differential and integral calculus.

Audience:

Generally apprehensive about mathematics. Backgrounds will vary although most have two years of high school mathematics.

Areas listing 116, 117 as suggested courses include: Agriculture (General and Industrial programs); School of Allied Medical Professions; College of the Arts (Division of Design, Visual Communication); Economics, Psychology, Biological Sciences.

Follow-up Courses:

Math 134 or Math 150 depending on student's need. Students interested in further course work in mathematics should consult the mathematics counselors in Math Building, room 110.

Text:

Barnett: College Mathematics for Management, Life and Social Sciences, (Dellen Publishing Co., San Francisco).

Suggested Course Content:

Sections	Topics	Approximate Number of Days
2-1 thru 2-6	Review of functions	3
9-1 thru 9-3	Limit, continuity, rate of change	4
9-4 thru 9-7	Derivative, formulas, chain rule	10
10-1 thru 10-6	Implicit, related rates, higher order derivatives, max., min., differential	10
11-1 thru 11-6	Integration	7
12-1 thru 12-5	Exponential and log	3
12-7	Improper integrals	3
13-1 thru 13-3	Several variables	5

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Course Coordinator: Jack Tull
Summer, 1983

Mathematics 130 4 cr. Elements of Algebra
A, W, Sp, Su

Prerequisite:

Math 102 or course code L, M, N or R on math placement test.

Catalog Description:

Equations, inequalities, linear functions, exponential and logarithmic functions, systems of equations, and matrix algebra.

Purpose of Course:

To introduce students to the pre-calculus mathematics needed in the Administration Sciences with emphasis on business related problems.

Audience:

Primarily freshmen or sophomores with majors in Administrative Science.

Background and Attitude of Audience:

The students electing this course have a very wide range of abilities and interests. Their background consists of some knowledge of high school algebra. They are generally a difficult audience to motivate.

Follow-up Courses:

Math 131, 132

Possible Text:

Haeussler and Paul: Introductory Mathematical Analysis, 4th Edition (Reston).

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Syllabus: (16 lectures, 3 exams)

	Topics (Text, Chapter-Section)	
1.	Exponents and Radicals, Operations with Fractions	(0.5, 0.6, 0.7, 0.8)
2.	Linear Equations and Rational Equations	(1-1, 1-2)
3.	Quadratic	(1-3, 2-1)
4.	Inequalities	(2-2, 2-3, 2-4)
	EXAM I	
5.	Functions and Graphs	(3-1, 2, 3)
6.	Lines and Parabolas	(4-1, 4-2)
7.	System of Equations	(4-3, 4-4)
8.	Applications of Linear Equations	(4-5)
9.	Exponential Functions	(5-1)
10.	Logarithmic Functions	(5-1, 5-2)
	EXAM III	
11.	Compound Interest	(6-1)
12.	Annuities - Amortization of Loans	(6-2, 6-3, 6-4)
13.	Matrix Algebra	(14-1, 14-2, 14-3)
14.	Reduction of Matrices	(14-4)
15.	Same	(14-5)
	EXAM III	
16.	Inverses, and/or Determinants and Cramer's Rule	(14-6)

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Course Coordinator: Monique Vuilleumier
Summer, 1983

Mathematics 131 4 cr. Elements of Calculus I
A, W, Sp, Su

Prerequisite:

Math 116 or 130 or 148 or 150 or OSU Math Course Code L

Catalog Description:

Limits, tangent lines, continuity, differentiability, mean value theorem, graphing techniques, sequences, Taylor's theorem, applications of calculus to business.

Purpose of Course:

The 131 and 132 courses are designed to introduce students in the College of Administrative Sciences to differential and integral calculus and related business applications. The courses are problem oriented and little rigor is introduced.

Audience:

Primarily freshmen or sophomores with majors in Administrative Science and some students in the biological sciences or agriculture.

Background and Attitude of Audience:

The students electing this course have a very wide range of abilities and interests. They are generally a difficult audience to motivate.

Follow-up Course:

Math 132

Possible Text:

Haeussler and Paul: Introductory Mathematical Analysis, 4th Edition, (Reston).

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Syllabus:

Topics (Text, Chapter-Section)

1.	Limits		(7-1, 7-2)
2.	Interest Compounded Continuously, Continuity		(7-3, 7-4)
3.	Continuity Applied to Inequalities		(7-5)
4.	Derivatives		(8-1)
5.	Rules for Differentiation, Derivatives as a Rate of Change		(8-2, 8-3)
6.	Differentiability and Continuity, Product and Quotient Rule		(8-4, 8-5)
7.	Chain Rule and Power Rule, Higher Order Derivatives		(8-6, 8-11)
8.	Derivatives of Logarithmic Functions, Derivatives of Exponential Functions		(8-7, 8-8)
9.	Implicit Differentiation, Logarithmic Differentiation		(8-9, 8-10)
10.	Intercepts and Symmetry		(9-1)
11.	Asymptotes		(9-2)
12.	Relative Maxima and Minima		(9-3)
13.	Concavity		(9-4)
14.	Second Derivative Test		(9-5)
15.	Applied Maxima and Minima		(9-6)
16.	Differentials, Elasticity	Optional	(9-7, 9-8)

Course Coordinator: Surinder Sehgal
Summer, 1983

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Mathematics 132 4 cr. Elements of Calculus II
A, W, Sp, Su

Prerequisite:

Math 131 or 117 or 151

Catalog Description:

Antiderivatives, techniques of integration, calculus of the logarithmic and exponential functions, surfaces in R^3, partial derivatives, Lagrange multipliers, applications of calculus to business.

Purpose of Course:

The 131 and 132 courses are designed to introduce students in the College of Administrative Sciences to differential and integral calculus and related business applications. The courses are problem oriented and little rigor is introduced.

Audience:

Primarily freshmen or sophomores with majors in Administrative Science and some students in the biological sciences or agriculture.

Background and Attitude of Audience:

The students electing this course have a very wide range of abilities and interests. They are generally a difficult audience to motivate.

Follow-up Courses:

Math 134

Possible Text:

Haeussler and Paul: Introductory Mathematical Analysis, 4th Edition, (Reston).

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Syllabus:

Topics (Text, Chapter-Section)

1.	Indefinite Integral, Integration Formulas	(10-1, 10-2)
2.	Techniques of Integration	(10-3)
3.	Summation, Definite Integral, Fundamental Theorem	(10-4, 10-5, 10-6)
4.	Area, Area Between Curves	(10-7, 10-8)
5.	Consumers and Producers Surplus	(10-9)
6.	Integration by Tables	(11-3)
7.	Average Value	(11-4)
8.	Improper Integrals	(11-6)
9.	Differential Equations	(11-7)
10.	Functions of Several Variables	(12-1)
11.	Partial Derivatives	(12-2)
12.	Applications of Partial Derivatives, Higher-Order Partials	(12-3, 12-5)
13.	Maxima and Minima	(12-7)
14.	Lagrange Multipliers	(12-8)

Course Coordinator: Robert Gold
Summer, 1983

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Mathematics 134* 5 cr. Elements of Calculus III
A, Sp

*COURSE CHANGED FROM MATH 221, effective Autumn 1983.

Prerequisite:

Math 132 or equivalent with written permission of the Department. It is recommended that students have a "B" or better in 131 and 132. Otherwise students should take 150, 151, and 152.

Catalog Description:

A continuation of Math 132. Differential and integral calculus of the trig functions, advanced techniques of integration, area, volume, surface area, work, moments and polar coordinates.

Purpose of Course:

To allow students completing the 130 sequence to move into the 150 sequence. Upon satisfactory completion of 131, 132 and 134, the student will have a topically equivalent background to those who have taken 150, 151, 152, and are eligible to enroll in 153.

Audience:

Generally Math-Stat or CIS majors in the College of Administration Science moving from the 130, 131, 132 sequence to the 151, 152, 153, 254 sequence.

Follow-up Courses:

Math 153

Text:

Ellis and Gulick: Calculus with Analytic Geometry, 2nd Edition.

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Mathematics 148 4 cr. College Algebra
A, W, Sp, Su

Prerequisite:

OSU Math Placement course code M or N or Math 104

Catalog Description:

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

Purpose of Course:

The two courses, Math 148 and 150, consist of precalculus concepts and skills needed by the student entering the regular calculus sequence (151, 152, etc.). The purpose of the two courses is to prepare the student for Math 151 (calculus).

Audience:

Students with majors in the College of Engineering and the College of Mathematical and Physical Sciences generally take this course. Some majors in the College of Agriculture, Education and the College of Biological Sciences also require this course.

Background and Attitude of Audience:

The students in this course have a very wide range of abilities and interests. Their background consists of some knowledge of high school algebra. The overall attitude of the student audience is good. They are usually well-motivated.

Follow-up Courses:

Math 150

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Topics List:

I. Fundamental Concepts of Algebra

Exponents -- integral and fractional
Radicals

II. Equations and Inequalities

Linear equations
Quadratic equations
Equations with radicals
Equations quadratic in form

III. Functions

Coordinate system
Relations and graphs
Functions -- one to one, onto, split functions
Graphs of functions -- domain and range
Altering of graphs by expansions, contractions, translations, and reflections

IV. Polynomial Functions, Rational Functions, and Conic Sections

Quadratic functions -- properties and graphs
Graphs of polynomial functions of degree > 2
Rational functions -- properties and graphs
Conic sections -- standard forms and graphs

V. Systems of Two Equations in Two Variables

VI. Introduction to Complex Numbers and Complex Roots of Equations

Text: Precalculus Mathematics. 2nd Edition, Flanders and Price

Chapters: 1 - 4 , 12.1, 12.5 - 12.7, 14. 1

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Course Coordinator: David Dean
Summer, 1983

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

Prerequisite:

OSU Math Placement Level M or Math 148.

Catalog Description:

Exponential, logarithmic and trigonometric functions and their graphs, inverse functions, complex numbers.

Purpose of Course:

This course treats the (non-algebraic) functions by the student entering the regular calculus sequence (151, 152, etc.). The purpose of Math 150 is to prepare the student for Math 151 (calculus). With 148, the course covers traditional pre-calculus mathematics.

Audience:

Students with majors in the College of Engineering and the College of Mathematics and Physical Sciences generally take this course. Some majors in the College of Agriculture, Education and the College of Biological Sciences also require this course.

Background and Attitude of Audience:

The students in this course have a wide range of interests and most need to take calculus. Most students have a strong algebra background and are well-motivated.

Follow-up Course:

Math 151

Text:

Flanders and Price: Precalculus Mathematics, 2nd Edition.

Chapters:

3.5, 5, 6, 7, 8, 14

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Topics List:

I. Review of functions and graphing techniques

II. Composite and Inverse Functions

III. Exponential and Logarithmic Functions

- Exponential functions -- properties and graphs
- Logarithmic functions -- properties and graphs
- Solving log and exp equations

IV. Right Triangle Trigonometry

- Angles
- Trig functions
- Evaluation of trig functions
- Inverse trig functions

V. General Trigonometry

- Trig functions
- Evaluating trig functions
- Properties of trig functions
- References angles
- Graphs of trig functions
- Graphs of $y = a \sin(bx \pm c)$ and $y = a \cos(bx \pm c)$
- Inverse trig functions

VI. Analytic Trigonometry

- Trig identities
- Trig equations
- Addition formulas
- Multiple angle formulas
- Sum and product formulas
- Laws of sines and cosines
- Vectors

VII. Complex numbers

- Definition of complex numbers
- Conjugates and inverses
- Complex roots of equations
- Trig form of complex numbers
- Powers and roots of complex numbers
- DeMoivre's Theorem

Course Coordinator: Bostwick Wyman
Summer, 1983

DEPARTMENT OF MATHEMATICS
THE OHIO STATE UNIVERSITY
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Mathematics 151, 152 5 cr. Differential and Integral Calculus
A, W, Sp, Su

Prerequisite for 151:

Math 150 or Course Code L.

Audience:

Students who plan to major in mathematics, engineering, computer science, or the physical sciences; also strong students in the social sciences or other areas that make significant use of mathematics.

Content:

151

Preliminaries (review of functions and graphing), limits, continuity, derivatives, tangents, max-min problems, curve sketching, related rates, derivatives of logarithmic, exponential, and trigonometric functions.

152

The integral, Fundamental Theorem of Calculus, applications, area and volume; integrals of log, exp, hyperbolic, inverse trig functions; methods of integration; polar coordinates.

Text:

Ellis and Gulick: Calculus with Analytic Geometry, 2nd Edition.

Course Coordinator: S. K. Wong
Summer, 1983

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Mathematics H151 - H152 5 cr. each Calculus and Analytic Geometry
H151C - H152C

Mathematics H263 or H263C 5 cr. Calculus

A - H151, H151C (H151 Summer)
W - H152, H152C (H152 Autumn)
Sp - H263, H263C

Prerequisite: Permission of department.

The Honors courses are accelerated versions of the regular sequence in calculus. They are designed to challenge well-prepared, highly motivated students regardless of their chosen major area of study. More personal responsibility is expected from the students in achieving the standard skill techniques than in the regular courses. Honors sections with a C suffix will make use of pocket computers or programmable calculators to enhance understanding of calculus and to ease the transition from theory to application.

For the first half of the fall quarter, Math H151 and H151C will cover, at an intensive pace, the topics of Math 151, so that a transfer to Math 151 or 151C may be made at the end of three weeks by those students who decide not to continue the accelerated track. After that time, University rules for adding and dropping courses apply. Students need a grade of at least B to continue in an honors sequence.

Although completion of these sequences is considered by the Mathematics Department to be equivalent in course content to Math 151, 152, 153, and 254, only 15 hours of credit will be earned. Students whose degree programs require mathematics through Math 254 will gain by having 5 more elective hours available to them as they pursue their own goals.

Students, who decide to leave the Honors Track at the end of fall term, will be advised as to future placement in mathematics sequences.

Topics Covered:

H151, H151C:

Differential calculus of one variable, (chap. 1-4, 9.1-9.7) sequences and series.

H152, H152C:

Integral calculus of one variable (chap. 5-8, 9.8-9.10).

H263

Multivariable calculus (vector approach), gradients, multiple integrals, line and surface integrals, Green's Theorem, divergence theorem, Stokes's Theorem, sequences and series (chap. 11-15).

Text:

Ellis and Gulick: Calculus with Analytic Geometry, 2nd Edition.

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Course Coordinator: Harry Allen
Summer, 1983

Mathematics 153, 254 5 cr. Differential and Integral Calculus
A, W, Sp, Su

Prerequisite for 153:

Math 152 or 134

Audience:

Students who plan to major in mathematics, engineering, computer science, of the physical sciences; also strong students in the social sciences or other areas that make significant use of mathematics.

Content:

153

Vectors and analytic geometry in two and three dimensions. Functions of several variables, partial derivatives, directional derivatives, gradient, extrema. Multiple integrals and applications. Cylindrical and spherical coordinates.

254

Sequences and series, Taylor's formula with remainder, power series. Vector calculus, line and surface integrals, Green's Theorem, vector fields, divergence theorem.

Text:

Ellis and Gulick: Calculus with Analytic Geometry, 2nd Edition.

Course Coordinator: Ted Scheick
Summer, 1983

DEPARTMENT OF MATHEMATICS
THE OHIO STATE UNIVERSITY
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Mathematics 180 5 cr. Insights into Mathematics
A, Sp

Prerequisite:

Course code L, M, N or R or Math 102 or 104.

Catalog Description:

A liberal arts course intended to involve students with mathematics rather than to develop computational and problem-solving skills; topics chosen by the instructor.

Purpose of Course:

Many students at The Ohio State University take mathematics course for the purpose of satisfying a graduation requirement but with no need for specific problem-solving skills. This course is a liberal arts course that emphasizes involvement with diverse problems in mathematics. There is no fixed course content. Rather, a faculty member offers a course treating topics in which he or she is interested in a manner that is accessible to students without prior training and without a "tool" need for mathematics.

We feel that this approach is the proper one for a liberal arts course. It enables us to take advantage of the interests of faculty members and to avoid problems inherent in offering a fixed subject matter course to a large audience. To date we have involved several faculty members offering a variety of topics. Four of the many topics used have been Computers in Society, Symmetry (in art and music), Topology, and Number Theory.

Audience:

Predominantly students in the College of Arts and Sciences and some students from the College of Education.

Course Coordinator:
Summer, 1983

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Mathematics 187 A | 2-5 cr. (repetable to a maximum of 10) | Topics in Mathematics

Recommended prerequisites:

Permission of Department.

Catalog description:

An enrichment course for interested and capable students.

Purpose of course:

The course is centered around problem solving and methods of approaching problems.

General information: H187(honors) may be available to students enrolled in and honors program or by permission of department. This course is graded S/U.

Audience:

Students primarily at the calculus level.

Possible texts:

Suggested course content:

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Course coordinator: Harry Allen
Autumn, 1983

Mathematics H190, H191, H263X 5 cr. Elementary Analysis

A - H190
W - H191
Sp - H263X

This three-quarter sequence comprises the first year of the honors program 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. It is taught by faculty members in small sections with considerable teacher-student interaction.

Topics Covered:

H190-H191

Properties of real numbers. Mathematical induction. Definition of integral. Integrals of polynomials and trig functions. Applications. Continuity, limits, derivative and applications. Fundamental theorem and integration techniques. Taylor series. Some first order differential equations. Complex number field. Sequences and series of numbers and functions. Uniform convergence. Power series.

H263X

Same as description for H263. (see H151)

Note: It has been the practice to have a separate section of H263, denoted by H263X, for students from H190 and H191. The content is essentially the same as that of the other H263 sections but the treatment is more rigorous.

Text:

Apostol: Calculus, Volume I.

Course Coordinator: Harry Allen
Summer, 1983

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

Prerequisite:

Math 254

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. After this course students should know some applications of ordinary differential equations in engineering, physics and some other branches of sciences.

Content:

1. First order Differential Equations with Applications.
2. Second Order Linear Equations with Applications.
3. Series Solutions of Second Order Linear Differential Equations.
4. Higher Order Linear Equations.
5. The Laplace Transform.
6. Numerical Methods.
*7. An Introduction to System of First Order Linear Equations.

Text:

Dennis Zill: A First Course in Differential Equations with Applications.

*This will be taught if time is allowed.

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Course Coordinator: Y. C. Lu
Summer, 1983

Mathematics 256 4 cr. Differential Equations with Applications
A, W, Sp, Su

Prerequisite:

Math 254

Catalog description:

First order differential equations, linear equations with constant coefficients, systems of linear equations, applications to vibrations problems and electrical networks. Not open to students with credit for 255, 415, 556.

Purpose of Course:

This differential equations course is designed to meet the specific needs of the Mechanical Engineering students.

Audience:

Almost all students will be from Mechanical Engineering.

Possible Texts:

Rainville and Bedient: A Short Course in Differential Equations;

A. A. Rabenstein: Introduction to Ordinary Differential Equations.

Content:

The content of 256 does not contain Laplace transformation or power series methods. It contains most of the other topics in 255 as well as systems of equations and additional applications.

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Suggested Outline I (from Rainville and Bedient):

Chapter 2, Equations of Order One, Sections 5 - 12	5 days
Chapter 3, Elementary Applications, Sections 13 - 15	3 days
Chapter 5, Linear Differential Equations, Sections 24 - 29	2 days
Chapter 6, Linear Equations with Constant Coefficients, Sections 33 - 37	2 days
Chapter 7, Nonhomogeneous Equations, Sections 38 - 41	1 day
Chapter 8, Variation of Parameters, Sections 44 - 45	1 day
Chapter 12, Applications, Sections 67 - 70	3 days
Chapter 13, Systems of Equations, Sections 71 - 79	7 days
Chapter 14, Electric Circuits and Networks, Sections 81 - 81	2 days
Supplementary Applications	2 days
Review before tests	9 days
Tests	3 days
	40 days

Suggested Outline II (from Rabenstein):

Chapter 1, All sections.

Appendices: A1, A2, A3, A4, and matrix multiplication

Chapter 2, Sections 1 - 12.

Chapter 8, All sections.

Course Coordinator: Frank Carroll
Summer, 1983

DEPARTMENT OF MATHEMATICS
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Mathematics H290-291-292 5 cr. Linear Algebra and Multi-Variable Calculus
A, W, Sp

(Substitutes for Math 568, 569; Math 556 (255, 256, 415) and Math 547 and 552)

Topics Covered:

H290

Vector spaces, linear maps, matrices, systems of equations, eigenvalues, eigenvectors, and determinants. Change of basis and triangular form. Positive definite matrices and spectral theory. Linear methods applied to multivariable calculus such as implicit function theorems.

H291

Linear differential equations, systems of linear differential equations, partial differential equations. Picard's existence and uniqueness theorem. Laplace transforms. Fourier series. Heat and wave equations. Sturm-Liousille boundary value problems.

H292

Content will vary from year to year depending on the audience.

Text:

Hoffman and Kienzil: Linear Algebra.

Course Coordinator: Harry Allen
Summer, 1983

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THE OHIO STATE UNIVERSITY
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Mathematics 345 4 cr. Foundations of Higher Mathematics
A, Sp

Prerequisite:

254 or permission of instructor.

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:

The intention of Math 345 is to build a solid foundation in those topics generally assumed, or only lightly touched upon, in advanced mathematics courses. It is a transitional course intended to follow calculus (254) and precede advanced calculus (547), abstract algebra (580), linear algebra (568), and/or topology (560).

Our 100 and 200 level math courses are basically designed to teach the tool aspect of algebra, geometry, and calculus, whereas in the 500 level mathematics courses it is important that the student be familiar with the concepts of proof and generalization. Some students are not ready to handle the abstraction of these courses without a preliminary introduction to the nature of the mathematical proof.

Audience:

Students will generally be sophomores who have completed a calculus sequence and anticipate some 500-level courses.

Text:

Stewart and Tall: The Foundations of Mathematics.

Suggested Course Content: (not necessarily in order of coverage):

1. Introduction to logic, including proof techniques: indirect proof, direct proof, mathematical induction.
2. Basic set theory, functions, equivalence relations.
3. Elementary number theory.
4. Integers and their properties.
5. Real numbers including a proof of the Archimedian principal.
6. Transfinite numbers (never seem to get to this).

Note: This course has been put in limbo effective Autumn, 1983 and will not be offered during 1983-84.

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Course Coordinator: Robert Gold
Summer, 1983

Mathematics 366 3 cr. Discrete Mathematical Structures I
A, W, Sp

Recommended prerequisites:

153 or permission of Department. Not open to students with credit for 576.

Catalog description:

Mathematical formalization and reasoning, mathematical induction, sets, mappings, binary relations, binary operations, Boolean Algebra, logic, elementary counting principles, monoids, groups, graphs.

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.

Audience:

Required for undergraudate students majoring in C.I.S. Students will usually be Sophomores or Juniors.

Possible texts:

Stanat & McAllister, Discrete Structures for Computer Science
Preparata & Yeh, Discrete Structures

Suggested course content:

I. Mathematical formalization
   A. Propositional Logic
   B. Proof Techniques
   C. Induction

II. Set Theory
   A. Naive sets, products
   B. Relations
   C. Functions
   D. Operations

III. Combinatorics
   A. Graphs
   B. Counting Principles

IV. Algebraic Structures
   A. Semigroups and monoids
   B. Groups
   C. Boolean algebras

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Course coordinator: Tom Dowling
Autumn, 1983

Mathematics 415 5 cr. Ordinary and Partial Differential Equations
A, W, Sp, Su

Prerequisite:

Math 254

Catalog Description:

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

Purpose of Course:

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

Audience:

The students usually come to the course from the Calculus sequence.

Background and Attitude of Audience:

This course was designed by a committee (primarily of engineers). It is intended to expose electrical engineering, astronautical engineering, and CIS students to problem solving in differential equations.

Possible Text:

Boyce and DePrima: Elementary Differential Equations and Boundary Value Problems, 3rd Edition.

Suggested Course Content:

Using Boyce and DePrima:

Sections	Days Spent
1.1, 1.2, 2.1 - 2.7 - First Order Differential Equations	7
3.1 - 3.62 - Second Order Differential Equations	10
4.1 - 4.7 - Series Solutions of Second Order	10
10.1 - 10.8 - Partial Differential Equations and Fourier Series	13
11.1 - 11. 6 - Boundary Value Problems and Sturm-Liouville Theory	5
Optional Material	3 - 5 Systems

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Course Coordinator: Joe Rosenblatt
Summer, 1983

Mathematics 416 5 cr. Vector Analysis and Complex Variables
A, Sp

Prerequisite:

Math 254

Catalog Description:

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

Purpose of Course:

The course is required in Aeronautical Engineering. Minimal proofs should be the rule (e.g., Cauchy Theorem by Green's Theorem rather than Cauchy-Goursat) or intuitive explanations. The vector analysis portion should be covered first.

Audience:

At present, almost all students are juniors in Aeronautical Engineering.

Possible Texts:

Schaum's Outline: Vector Analysis;

Churchill, Brown, and Verhey: Complex Variables.

Suggested Course Content:

A combination of 514 (complex variables) and 513 (vector calculus).

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Suggested Schedule:

Vector analysis -- 15 classes including tests.

Complex variables -- 15 classes including tests.

1. Comment -- Use first 3 weeks of quarter for vector analysis. Line integrals and Green's Theorem needed for complex variables. Gauss and Stokes Theorems needed for engineering courses taken concurrently.

Schedule: Vector Analysis

Chap. 1 - 4 - Vectors, Dot and Cross Product, Vector Differentiation - 4 classes -- treat as review

Chap. 5 - Vector Integration - 5 classes -- include independence of path

Chap. 6 - Divergence Theorem - 5 classes -- Gauss, Green, Stokes. Omit p. 107.

2. Schedule: Complex Variables

Chap. 1 -- 3 classes - Complex Numbers

Chap. 2 -- 4 classes - Analytic Functions

Chap. 3 -- 4 classes - Elementary Functions

Test

Chap. 4 -- 5 classes - Mapping by Elementary Functions

Chap. 5 -- 5 classes - Integrals

Chap. 6 -- 4 classes - Power Series

Test

Chap. 7 -- 6 classes - Residues and Poles

Overall comment -- Run as a problem course. Minimal proofs.

Course Coordinator: Joe Rosenblatt
Summer, 1983

DEPARTMENT OF MATHEMATICS
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Mathematics 471 5 cr. Matrices and Linear Algebra
A, W

Prerequisite:

Math 153 or equivalent with permission of department.

Catalog Description:

Not open to students with credit for 571, 568, or 577. Matrices, systems of equations, R^n , determinants; vector spaces; applications.

Purpose of Course:

The purpose of the course is to provide an elementary introduction to the concepts, vocabulary, notation, and results of matrix and linear algebra. It does not contain the depth of material of H290, 568, and 569 or 577. Further, emphasis is placed on the topics as tools rather than as development of structure; 4 - 5 weeks are devoted to linear programming.

Audience:

The course is required for CIS majors in the College of Administrative Science. Students are not too strong mathematically and not always well motivated. They have a strong desire to see application of this material. They also have a dislike for formalism and often bring quite a bit of computer experience to the course, i.e., a "how-to-solve-it" approach.

Text:

Kolman and Beck: Elementary Linear Programming with Applications, Academic Press.

Suggested Course Content:

Matrices -- arithmetic, inverse, transpose, rank;

Systems of equations -- homogeneous and nonhomogeneous;

Vector spaces -- R^n , independence, spanning sets, basis;

Convex sets, basic feasible solutions, extreme points

Linear Programming

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Course Coordinator: Bostwick Wyman
Summer, 1983

Mathematics 487 2 cr. Advanced Problem Solving
A (repeatable to a maximum of 6)

Recommended prerequisites:

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 standard program.

General information:

This course is graded S/U. This course may not be counted on a major or minor program in mathematics.

Audience:

Primarily upperclassmen.

Possible texts:

Polya, Problem Solving in Mathematics

Suggested course content:

I. Techniques of problem solving
II. Problems in analysis
III. Problems in number theory
IV. Problems in abstract algebra
V. Problems in combinatorics

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Course coordinator: Harry Allen
Augumn, 1983

Mathematics 501, 502, 503 4 cr. each Fundamentals of Mathematics I, II, III

A -- 501
W -- 502
Sp -- 503

Catalog Description:

The integrated sequence 501, 502 and 503 covers the calculus of one and several variables with applications to statistics, economics and the social sciences.

Purpose of Course:

This course serves those graduate students in departments outside the College who need mathematics in their majors but whose undergraduate training in mathematics is insufficient.

Audience:

This course is intended for advanced students in areas other than the mathematical and physical sciences.

Suggested Course Content

This is an integrated sequence in calculus, with topics from algebra and analytic geometry introduced as needed. The course content is essentially the same as the mathematics sequence 151, 152, 153 and 254, with the exception that some of the theory is deleted and the emphasis is on applications to statistics, economics and social sciences.

Content includes lines, slopes, limits, derivatives, applications of derivatives to curve sketching, maxima and minima, approximations; antidifferentiation, the definite integral, Fundamental Theorem of Calculus; area, volume, other applications of integration; logarithmic, exponential, trigonometric and inverse trigonometic functions; integration techniques; indeterminate forms; improper integrals; Taylor's formula; infinite series; differential calculus of functions of several variables; multiple integration.

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Course Coordinator: Archie Addison
Summer, 1983

Mathematics 504 5 cr. The History of Mathematics
Sp

Prerequisite:

Math 580 or 568 or 507 or permission of instructor.

Catalog Description:

Development of mathematics from primitive origins to present forms. Topics include development of arithmetic, algebra, geometry, trigonometry, and calculus.

Purpose of Course:

This course is an introduction to the History of Mathematics. The purpose of this course is to expose the students to the good mathematics of yesteryear. Also, an attempt is made to tie the evolution of mathematics to the socio-economic conditions of the times.

Audience:

This course is principally a service course for the Math Education department. It is not recommended in the 40-hour requirement necessary for a math major. However, if taken as an elective, it could benefit the math major greatly. (95% of the audience are Math-Ed students.)

Background and Attitude of Audience:

The background and motivation of the average student in this course is poor. The students often have difficulty organizing their thoughts on paper.

Follow-up Courses:

None

Possible Texts:

Howard Eves: An Introduction to the History of Mathematics, 4th Edition, (Holt, Rinehart and Winston);

Carl B. Boyer: A History of Mathematics (Wiley);

C. H. Edwards, Jr.: The Historical Development of Calculus (Springer).

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Suggested Course Content:

(Note: * means that this must be included in the course.)

1. *Reading: (1) Eves or some other general history on mathematics;
(2) at least two books of Euclid's, Elements.

2. *Term paper: This paper is to be at least 80% mathematics and the rest history. The purpose of the paper is to have the student dig in and learn a certain portion of mathematics well, and then present it.

3. Lecture topics (most probable): at least one will be explored thoroughly:

counting and the abacus
general solution of the polynomial equation
irrational numbers
astronomy and its effect on the development of math
Cantor theory
conic sections
calculus
the parallel postulate and non-Euclidean geometry
Euclid's Elements
axiomatics
Boolean algebra.

4. Other outside reading

(Note: there are many other good sources.)

Course Coordinator: Charles Saltzer
Summer, 1983

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Mathematics 507 5 cr. Advanced Geometry
A, W

Prerequisite:

Math 152 (Integral Calculus)

Catalog Description:

Advanced topics from Euclidean Geometry.

Purpose of Course:

To review and clarify high school geometry, and to introduce some advanced topics as extensions of elementary Euclidean geometry.

Audience:

The course is required for College of Education students specializing in the teaching of secondary school mathematics. A few of the students are enrolled in Arts and Sciences or Engineering.

Most students have weak backgrounds in high school geometry and analytic geometry. Their preparation has markedly deteriorated during the past 10 years.

A Possible Text:

George Martin: Transformation Geometry (Springer Verlag).

Suggested Course Content:

1. Review of high school geometry.
2. Euclidean motions and similarities.
3. (Circular inversion or Finite Geometries).

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Course Coordinator: Arno Cronheim
Summer, 1983

Mathematics 512 | 3 cr. | Partial Differential Equations and Boundary Value Problems
A, W, Sp, Su

Prerequisite:

255, 256, or 556

Catalog Description:

Among the topics considered are: Fourier series, orthogonal relations, vibrating string, steady state heat, Laplace transform, and applications.

Purpose of Course:

Lots of problem-solving and little theory.

Audience:

Graduate and advanced undergraduate engineers.

Background and Attitude of Audience:

Derivation of the partial differential equations of vibrating string, transmission lines, etc., is not expected. Solutions of these equations and interpretation of the solutions is expected.

Possible Texts:

1. O'Neil: Advanced Engineering Mathematics (Wadsworth).

2. Kreyszig: Advanced Engineering Mathematics (Wiley).

These books contain most of the material needed, and much more. They are good reference books for engineers to own, especially if they intend to take further mathematics courses. They can also be used for 513 and 514.

Suggested Course Content:

This course is a three hour course with a lot of material with little emphasis on theory. A detailed outline based on the following texts is available and should be followed.

Fourier series.

Separation of variables and linear partial differential equations.

Laplace transform: definition and elementary properties.

Applications to ordinary linear differential equations.

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

1. Fourier Series: 8 days including a test.

   Trigonometric and Fourier series. Convergence theorem. Even and odd functions and extensions of functions. Half range expansions. Other topics may be included if you have time, e.g., complex Fourier series, series, double Fourier series.

   O'Neil: Chapt. 12, Sections 12.0 - 12.4 and 12.8.

   Kreyszig: Chapt. 9, Sections 9.1 - 9.5; 9.7 and 9.8 optional.

2. Partial Differential Equations: 8 days including a test.

   Boundary value problems are to be considered for: one dimensional wave equation (series and D'Alembert solution); one dimensional diffusion equations; and Laplace's equation in the plane. The method of separation of variables is used. The differential equations need not be derived. Do many examples of each type. No use of Bessel functions.

   O'Neil: Chapt. 13, Sections 13.0, 13.2, 13.3 (13.6 optional).

   Kreyszig: Chapt. 11, Sections 11.1, 11.3 - 11.5. Skimpy on Laplace's equation.

3. Laplace Transform: 9 days including a test.

   Basic properties of the Laplace transform. Existence theorem (stated). Transform of derivatives. Partial fractions. Inverse transform. Solution of ordinary linear differential equations with constant coefficients. Transforms of periodic functions. The "Second Shifting Theorem" and applications. Systems of differential equations and Convolution formula, if time allows.

   O'Neil: Chapt. 4, Sections 4.0 - 4.9.

   Kreyszig: Chapt. 4, Sections 4.1 - 4.9.

4. Application of Laplace transform to solving partial differential equations or other topics you feel are interesting or important: 3 days.

   This will depend on the text you use.

Course Coordinator: Ted Scheick
Summer, 1983

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Mathematics 513 3 cr. Vector Analysis for Engineers
W

Prerequisites:

Math 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 surface integrals. Ample class time should be devoted to problems.

Audience:

Students are mainly graduate engineers whose last course was several years ago.

Possible Texts:

Schey: Div, Grad, Curl and All That;

Schaum's: Vector Analysis;

Lindgren: Vector Calculus;

Kreyszig: Advanced Engineering Mathematics (chapts. 7 and 8).

(This is also a good reference book for engineers. It can also be used for 512, 514.)

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(over)

Suggested Course Content:

From Lindren: level of text is about right. Supplementary problems (e.g., Schaums's: Vector Calculus) will be needed.

Suggested Schedule:

		Days
Chapt. 1 --	Vector algebra, geometry, operations. (As this is review, more time produces less interest.)	3
Chapt. 2 --	Vector functions of 1 variable, space curves, arc length. Parametrization of curves is difficult.	6
Chapt. 4 --	Vector functions of position, chain rule surfaces, del operator, line and surface integrals. Parametrization of surfaces.	10
Chapt. 5 --	Integral theorems: Gauss, Green, Stokes, path independence.	7

Course Coordinator: Ted Scheick
Summer, 1983

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Mathematics 514 3 cr. Complex Variables for Engineers
Sp

Prerequisite:

513 or equivalent (so some time on line integrals may be saved and Green's Theorem may be used to get the Cauchy integral theorem).

Catalog Description:

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

Purpose of Course:

Subject matter needed in engineering courses.

Audience:

A "skills" course for undergraduates and graduate engineers.

Background and Attitude of Audience:

Do not overestimate the students' computational skills because they are engineers; in fact, class discussion of assigned problems is helpful. Discuss the theory, but spend most of the time sharpening computational skills and showing them how to use the theory.

Possible Texts:

1. Churchill: Complex Variables and Applications (a bit hard to read for students);
2. Smith: Elementary Complex Variables (Merrill);
3. Kreyszig: Advanced Engineering Math.

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

Every suggested text has too much material, so it is helpful to give a review sheet before tests. These students want the text for reference and the lectures to make the text understandable.

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Suggested Course Content:

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

Syllabus based on Kreyszig: (2 tests and a final exam).

11. Complex analytic functions.	9
12. Conformal mapping (omit 12.6).	4
13. Complex integrals.	5
14. Sequences, series (just state definitions and the theorems on power series).	1/2
15. Taylor and Laurent series.	2 1/2
16. Integration by residues.	6
17. Complex functions and potential theory: only if you have some time left over and the students are well-versed with the above material.	

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Course Coordinator: Ted Scheick
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Mathematics 530 3 cr. Probability I
A

Prerequisite:

Math 254

Catalog Description:

Axioms of probability, combinatorial probability, random variable, independence and conditioning, expectation, variance, law of large numbers.

Purpose of Course:

The student is exposed to the foundations of modern probability theory and its applications. His understanding of analysis is strengthened by its use in probability theory.

Audience:

Majors in mathematics, physics, engineering (especially electrical engineering), biological sciences. There are many students in the course who are not mathematics majors. For the most part, the students are interested and hard-working.

Follow-up Course:

Math 531

Possible Text:

K. L. Chung: Elementary Probability Theory with Stochastic Processes.

Syllabus:

Sets
Probability
Counting
Random variables
Independence and conditioning
Mean, variance, law of large numbers
Exams and review

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Course Coordinator: Louis Sucheston
Summer, 1983

Mathematics 531 3 cr. Probability II
W

Prerequisite:

Math 530

Catalog Description:

Continuation of 530; examples of distributions, independence, conditional and marginal distribution, laws of large numbers, central limit theorem.

Purpose of Course:

The student is exposed to the foundations of modern probability theory and its applications. His understanding of analysis is strengthened by its use in probability theory.

Audience:

Majors in mathematics, physics, engineering (especially electrical engineering), biological sciences.

Background and Attitude of Audience:

There are many students in the course who are not mathematics majors. For the most part the students are interested and hard-working.

Follow-up Courses:

Before a student takes further probability theory, he will need 651 - 653.

Possible Text:

K. L. Chung: Elementary Probability Theory with Stochastic Processes.

Syllabus:

Poisson and normal distributions.
Markov chains.
Additional topics.
Exams and review.

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Course Coordinator: Louis Sucheston
Summer, 1983

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

Prerequisite:

254 or permission of instructor.

Catalog Description:

The first course of a three-course sequence designed to develop analytic intuition and proof skills; student participation is emphasized; real numbers, sequences, series, continuous functions.

Audience:

The students will be principally mathematical and physical science majors and engineers. Math 547 and 548 currently satisfy the analysis requirement for a math major.

Follow-up Courses:

Math 548, 549.

Possible Texts:

Avner Friedman
Watson Fulks
Anthony Labarre
Angus Taylor amd Robert Mann

Suggested Course Content:

547, 548, 549 is a sequence designed to develop analytic intuition and proof skills. Student participation is emphasized. Real numbers, sequences, series continuous functions.

Topics to be covered (not necessarily in order):

1. The structure of the real numbers.

2. A careful study of limits of sequences, series, and properties of the limit process; here it is proved that a bounded sequence of real numbers has a convergent subsequence.

3. A study of continuous functions including the proofs of the intermediate value theorem and the theorem that a continuous function on a closed bounded interval is uniformly continuous.

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Course Coordinator: Alayne Parson
Summer, 1983

Mathematics 548 3 cr. Introductory Analysis II
W, Sp, Su

Prerequisite:

547 or permission of instructor.

Catalog Description:

Continuation of 547; sequence of functions, differentiation, the Riemann integral.

Audience:

The students will be principally mathematical and physical science majors and engineers. Math 547 and 548 currently satisfy the analysis requirement for a math major.

Follow-up Courses:

Math 549 or 551 or 552.

Possible Texts:

Avner Friedman
Watson Fulks
Anthony Labarre
Angus Taylor and Robert Mann

Suggested Course Content:

547, 548, 549 is a sequence designed to develop analytic intuition and proof skills. Student participation is emphasized. Sequences of functions, differentiation, the Riemann integral.

548 is a continuation of 547 including the following topics:

1. Properties of limits of sequences of functions.

2. An exploration of functions having a derivative, with proofs of the mean-value theorem and Taylor's theorem with remainder.

3. The development of the fundamental theorem of the calculus, substitution formulas and an examination of functions having a Riemann integral.

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Course Coordinator: Alayne Parson
Summer, 1983

Mathematics 549 3 cr. Introductory Analysis III
Sp

Prerequisite:

548 or permission of instructor.

Catalog Description:

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

Audience:

The students will be principally mathematical and physical science majors and engineers.

Follow-up Courses:

Math 551 or 552.

Possible Text:

Watson Fulks

Suggested Course Content:

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

Topics included would be:

1. An introduction to functions of bounded variations through the study of the Riemann-Stieltjes integral.

2. The calculus of several variables with the emphasis on differentiable functions, Green's theorem and then multiple integration; including proofs that iterated integrals do compute volumes under sufficiently strong hypotheses.

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Course Coordinator: Alayne Parson
Summer, 1983

Mathematics 551 | 5 cr. | Vector Analysis
A, Sp

Prerequisite:

Math 254

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, 551.01 or 551.02.

Possible Texts:

R. creighton Buck: Advanced Calculus;

With supporting problems from Schaum's.

Suggested Course Content:

Differentials of transformations. The implicit function theorem. Integrals over curves and surfaces. Differential forms. The theorems of Green, Gauss and Stokes. Applications.

Course Coordinator: H. Moscovici
Summer, 1983

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Mathematics 552 5 cr. Complex Variables I
W, Su

Prerequisite:

Math 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 chapters of Churchill. The fact that it is a 5 hour course permits more depth than is possible in 514 or 416. Because the course has minimal prerequisites, the emphasis will be on problem techniques.

Audience:

Recommended in a math major program. Required in the Physics program (they take 551 and 552, but not advanced calculus). Occasional engineering graduate students.

Background and Attitude of Audience:

Good.

Follow-up Courses:

All graduate applied math, and many science and engineering courses.

Possible Texts:

Churchill, Kaplan, a dozen others.

Suggested Course Content:

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

Course Coordinator: A. Parson
Summer, 1983

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Mathematics 556 3 cr. Differential Equations I
A, Sp

Prerequisite:

Math 254

Catalog Description:

First and second order equations; series and approximate solutions of linear equations; existence and uniqueness of solutions.

Purpose of Course:

This is not intended to be a cookbook problem solving course in ordinary differential equations, but should be considered as a brief introduction to the theory and solution of initial value problems.

The emphases of the course are (1) First and second order linear differential equations; (2) series and solutions of linear differential equations and (3) Euler's proof and existence and uniqueness of solutions for linear equations and naturally the Euler's numerical method of solutions.

Audience:

The sole prerequisite is the calculus sequence. We can expect the students in this course to have a wide range of mathematical backgrounds. Therefore knowledge of uniform convergence and familiarity with power series cannot be assumed.

We are likely to find a large portion of the audience to be physics, CIS and math majors. In view of the first group, examples are in order; for the second group, it will be interesting to get some computer time and do a little numerical work in conjunction with approximation of solutions. For math majors, the philosophy in this course is to build a bridge between the calculus sequence and more advanced analysis courses. For instance, uniform convergence will naturally be introduced in finding solutions by approximation.

Syllabus:

Topics (not necessarily in order of coverage):

1. First order differential equations.

2. The existence-uniqueness theorem: Picard iteration.

3. Difference Equations, numerical approximations.

4. Second order linear differential equations.

5. Series solutions of linear equations.

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Course Coordinator: Y. C. Lu
Summer, 1983

Mathematics 557 3 cr. Differential Equations II
W

Prerequisite:

Math 556

Catalog Description:

Systems of first order equations; qualitative theory for ordinary differential equations; introduction to partial differential equations and boundary value problems.

Course Objectives:

This is a continuation of Math 556. Systems of first order equations and qualitative theory of differential equations are essential ingredients in this course. Examples and applications of differential equations are expected to be emphasized. Partial differential equations are also to be introduced.

Syllabus:

Topics (not necessarily in order of coverage):

1. Review of vector spaces as introduced in the basic calculus sequence.
2. Systems of first order equations -- the eigenvalue-eigenvector method of finding solutions.
3. Qualitative theory of differential equations: stability of equilibrium solutions; Poincare-Bendixon Theorem.
4. Introduction to partial differential equations; separation of variables and Fourier series.

Course Coordinator: Y. C. Lu
Summer, 1983

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Mathematics 558 W | 3 Cr. | Differential Geometry of Curves and Surfaces

Recommended prerequisites:

H292 or both 568 and one of 547 or 551.

Catalog description:

Introduction to the classical differential geometry of curves and surfaces, both in its local and global aspects.

Purpose of course:

To provide a senior year option for honors students and simultaneously a differential geometry course below the 800 level for students of mathematics, science, and engineering.

Audience:

Possible texts:

Manfredo P. de Carmo, Differential Geometry of Curves and Surfaces

Suggested course content:

I. Curves
- A. Parametrized curves
- B. Regular curves; arc length
- C. The vector product
- D. The parametrization by arc length
- E. Global properties of plane curves

II. Suraces
- A. Regular surface
- B. Inverse images of regular values
- C. Change of parameters and differentiable functions on surfaces
- D. The tangent plane; the differential of a map
- E. The First Fundamental Form; Area

III. The Gauss normal map
- A. Definition and basic properties
- B. The Gauss map in local coordinates
- C. Ruled surfaces

IV. Intrinsic geometric properties
- A. Isometrics; conformal maps
- B. Theorema Egregium
- C. Parallel transport; geodesics
- D. The Gauss-Bonnet theorem and applications

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Course coordinator: Henry Moscovici
Autumn, 1983

Mathematics 559 3 cr. Topological Concepts
W

Prerequisite:

Math 254 or permission of department.

Catalog Description:

Rubber sheet and combinatorial geometry, networks, four-color theorem, surfaces, Euler characteristic, applications to fixed point theory and calculus.

Follow-up Courses:

Math 560, 655, 656, 657

Suggested Text:

B. Arnold: Intuitive Concepts in Elementary Topology.

Suggested Course Content:

The catalog description is accurate.

Course Coordinator: Norman Levine
Summer, 1983

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Mathematics 560 3 cr. Point-set Topology
Sp

Prerequisite:

Math 547 or 559 or permission of department.

Catalog Description:

Metric spaces, abstract topological spaces, limits, convergence, continuity, compactness and connectedness.

Follow-up Courses:

Math 655, 656, 657

Possible Texts:

1. Krariel: Undergraduate Topology;
2. Moore: Elementary General Topology;
3. Gemignani: Elementary Topology;
4. Pervin: Foundations of General Topology.

Suggested Course Content:

The catalog description is accurate.

Course Coordinator: Norman Levine
Summer, 1983

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Mathematics 566 3 cr. Discrete Mathematical Structures II
A, W, Sp (first offering W/84)

Recommended prerequisites:

366 or permission of department. Not open to students with credit for 576.

Catalog description:

Elementary number theory, coding theory; continuation of groups, graphs, and enumeration from 366 with applications to topics in computer science.

Purpose of course:

Follow up to Math 366.

Audience:

Required for some undergraduate students majoring in C.I.S. Students will usually be Sophomores or Juniors.

Possible texts:

Stanat & McAllister, Discrete Structures for Computer Science

Suggested course content:

I. Elementary Number Theory
   A. Divisibility
   B. Primes
   C. Congruences
   D. Chinese Remainder Theorem
   E. Finite fields

II. Coding Theory
   A. Morphisms of structures
   B. Finite state machines
   C. Computability
   D. Formal languages

III. Applications
   A. Morphisms of structures
   B. Finite state machines
   C. Computability
   D. Formal languages

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Course coordinator: Tom Dowling
Autumn, 1983

beginning Summer quarter 1984

COURSE DESCRIPTION: MATH 568

TEXT: Elementary Linear Algebra (Third ed.) by Shields

AUDIENCE: Primarily science (including Mathematics) majors unskilled in proofs.

PURPOSE: An introduction to the theory and algorithms of linear algebra. The course should provide an introduction to the art of proof making as well as develop the mechanics of the algorithms.

RELEVENT SECTIONS

Chapter 1; sections 1 - 3A
Chapter 2; sections 1 - 6
Chapter 3; sections 1 - 6
Chapter 4; sections 1 - 3
Chapter 5; sections 1 - 6

REMARKS

There are 25 sections, which about cover the relevent material. If one averages one section a day, that leaves 5 days for exams and allows for the expression of personal tastes.

To do the characteristic polynomial without the determinant, there is an algorithm (related to one of Danilevskii) that is suitable for the classroom (see McWorter (2-5991) for details). Students have found it superior (reluctantly; it is not in the book) to the usual determinant because it is faster for matrices larger than 3x3 and provides an easier route to associated eigenvectors. One can regard the algorithm as a generalization of finding eigenvalues and eigenvectors via the minimum polynomials of a basis. These polynomials (including the characteristic polynomial) are not as hard to find as it might appear at first. With the exception of the uniqueness of the characteristic polynomial (which we cede to the determinant), the theorems of Chapter 5 follow easily.

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Mathematics 568 3 cr. Linear Algebra I
A, W, Sp, Su

Prerequisites:

153 or permission of department. Not open to students with credit for 471 or 577.

Catalog Description:

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

change for next yr. as per msworter

Audience:

In the sequence 568 and 569, the emphasis is placed on techniques and computational skills. The students would be predominantly sopohomores having no prior experience with linear algebra or "proof". Along with servicing mathematics majors, the course will probably also enroll students in the physical sciences, secondary math education, CIS, engineering, and mathematical sciences.

Follow-up Courses:

For math and education majors: the sequence 580, 581, 582.

For service: 569.

Possible Text:

Johnson and Reiss: ~~An~~ Introduction to Linear Algebra.

change for next year

(over)

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Suggested Course Content:

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

Topics to be covered (not necessarily in order of coverage):

1. The space $\mathbb{R}^n$ (addition and scalar multiplication).
2. Subspaces of $\mathbb{R}^n$ (geometric descriptions; indepedence; spanning sets, basis and dimension).
3. Matrices as descriptions for mappings of $\mathbb{R}^n \to \mathbb{R}^m$; informal introduction of characteristic roots and vectors.
4. Algebra of matrices (addition, multiplication, transpose, inverses).
5. Determinants and properties (relation to matrix inverses).
6. Systems of equations (homogeneous; non-homogeneous, kernel and image spaces of matrix as mappings; rank; nullity, Cramer's rule, Echelon forms).
7. Standard inner product (dot product) in $\mathbb{R}^n$; orthgonality and orthonormal bases.

Suggested additional topics as time permits: further experience with characteristic roots and vectors; other vector spaces over $\mathbb{R}^n$, e.g., the space of matrices, function spaces.

Course Coordinator: Willie McWorter
Summer, 1983

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Aut 84

COURSE DESCRIPTION: MATH 568

PURPOSE: An introduction to the theory and algorithms of linear algebra.

RECOMMENDED TEXT: Elementary Linear Algebra by Shields (see [2])

The audience consists primarily of science (including Mathematics) majors. The thrust of the course should include an introduction to proofs as well as the mechanics of the algorithms. Understanding of the underlying theory is more evident here than in methods courses such as Math 471.

Below is an outline of topics recommended for this course.

SYSTEMS OF LINEAR EQUATIONS
- preferred method of solution: Gauss elimination
- translation to matrices
- analysis of solutions (direct and geometric)
- echelon form (uniqueness of reduced echelon form)
- analysis of solutions (e.g., rank, 'free' variables, 'independent' equations)

MATRIX OPERATIONS
- dot product of vectors
- systems as vector equations
- sum and product of matrices (matrices as vector functions)
- systems as matrix equations (roots of vector functions)
- laws of square matrices (associativity of function composition)
- invertible matrices and linear systems

LINEAR INDEPENDENCE AND SPANNING
- n-space as a vector space
- linear combination of vectors (relation to geometry and linear systems)
- linear independence (relation to geometry and linear systems)
- algorithms for determining independence
- general results on independence (and interpretation for

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geometry, linear systems, matrix algebra)

VECTOR SPACES

- important spaces other than n-space (e.g., polynomial spaces and function spaces)
- subspaces
  - subspace proofs
  - the four subspaces associated with matrices and linear systems and algorithms for their computation
  - spanning sets for subspaces and algorithms
  - bases for subspaces and algorithms
  - subspace description of solution sets of linear systems
- dimension
  - dimension theorems
  - relation with geometry and linear systems
- orthogonality
  - orthogonal complements
  - relation between row space and null space of a matrix
  - orthogonal basis
  - projection
  - Gram-Schmidt

EIGENVALUE PROBLEM

- eigenvalues and eigenvectors via minimum polynomial of a ~~matrix~~ vector
- properties of eigenvalues and eigenvectors
- diagonal matrices and similarity
- characteristic polynomial (determinant definition - leaving "determinant" undefined)
- extend algorithm for minimum polynomial of a vector to one for characteristic polynomial (see [1])
  - companion and Frobenius matrices
  - Cayley-Hamiltion theorem
  - recipe for basis of eigenvectors (see [1])
- diagonalizability
  - spectral theorem (real symmetric matrices)
  - simple applications (e.g., Markov processes)

There are 25 sections in Shields[2] which about cover the material outlined above. If one averages one section a day, that leaves 5 days for exams and gives the teacher room to express his or her personal preferences. These sections are:

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CHAPTER 1
sections 1, 2, 3, 3A
CHAPTER 2
sections 1, 2, 3, 4, 5, 6
CHAPTER 3
sections 1, 2, 3, 4, 5, 6
CHAPTER 4
sections 1, 2, 3
CHAPTER 5
sections 1, 2, 3, 4, 5, 6

[1] McWorter, W. A.. An Algorithm for the Characteristic Polynomial, Mathematics Magazine, vol. (1980), pp.
[2] Shields, P. C.. Elementary Linear Algebra (third ed.), 1980, Worth Publishers, Inc.

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Mathematics 569 3 cr. Linear Algebra II
W, Sp, Su

Prerequisites:

568 or permission of department. Not open to students with credit for 471 or 577.

Catalog Description:

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

delete phrase for next year

as per McWorter

Audience:

Predominantly a service course for physical sciences, CIS, engineering and mathematical sciences majors.

Follow-up Course:

Any course having a linear algebra prerequisite.

Possible Text:

Johnson and Reiss: An Introduction to Linear Algebra.

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(over)

Suggested Course Content:

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

Topics to be covered (not necessarily in order of coverage):

1. Definitions and examples of vector spaces over $\mathbb{R}$ and $\mathbb{C}$ (include $M_{m,n}(\mathbb{R})$ and function spaces).

2. Definition of linear transformations; kernel, image, isomorphisms; dimension relations.

3. Vector space structure of $\mathrm{Hom}_{\mathbb{R}}(V,W)$ and relation to $M_{m,n}(\mathbb{R})$ with choice of bases.

4. Elementary properties of the polynomial ring $\mathbb{R}[x]$ ($\mathbb{C}[x]$) ; definition of minimal polynomial and characteristic polynomial.

5. Characteristic roots and characteristic vectors; diagonalizaation of matrix.

6. Symmetric matrices; inner products and quadratic forms.

7. Principal Axis Theorem (at least squares and spectral theory).

For the service aspects of the course (statistics, physics, engineering), the latter two topics are of importance. A fairly thorough treatment of these should be included; if time permits, we could treat canonical forms.

Course Coordinator: Willie McWorter
Summer, 1983

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MATH 569 Johnson + Russ
Su84

Review Chap. 3 3.1 – 3.6 (perhaps in context of Chap. 4)

Chap. 4 4.1 – 4.5, 4.6 (and 2.6), 4.7 – 4.10

pad above with applications that suit you.

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Mathematics 573 5 cr. Elementary Number Theory
W

Prerequisite:

Math 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 give students an introduction to some ideas in abstract algebra, and more particularly the discipline of number theory; for students to develop reasonable facility in the formulation of proof.

Audience:

Audience is varied: for some a first course in presenting mathematical proof.

Possible Text:

Niven and Zuckerman: An Introduction to Theory of Numbers, 3rd Edition.

Suggested Topics (not necessarily in order of coverage):

1. Divisibility properties of Z ; primes, euclidean algorithm, unique factorization, greatest common divisors, least common multiples.
2. Linear diophantine equations.
3. Congruences; Euler's function, Euler-Fermat Theorem, primitive roots.
4. Linear congruences, Chinese Remainder Theorem, Quadratic congruences, Reciprocity Law.
5. Extensions and generalizations: polynomial rings over fields; quadratic number fields.

Course Coordinator: Paul Ponomarev
Summer, 1983

DEPARTMENT OF MATHEMATICS
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Mathematics 574 5 cr. Geometry
A

Prerequisite:

Math 568 or permission of instructor.

Catalog Description:

Euclidean and non-Euclidean geometry, emphasizing algebraic connections; affine and projective planes, duality, and finite planes.

Purpose of Course:

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

Audience:

Anyone interested in geometry. Mathematics majors, and undergraduate or graduate majors in mathematics education.

Course Content:

Construction of real projective plane from affine plane, barycentric and homogeneous coordinates, duality, affine and projective transformations, double ratio. Conic sections, and the group of a conic section. Klein's model of hyperbolic geometry. Exercises on projective planes over Z mod p .

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Course Coordinator: Arno Cronheim
Summer, 1983

Mathematics 575 5 cr. Combinatorial Mathematics and Graph Theory
W, Sp

Prerequisite:

Math 568 or permission of instructor.

Catalog Description:

Some classical puzzles of recreational mathematics: matching theory, graph theory, network flows, and optimization; enumeration techniques; combinatorial design and coding theory.

Purpose of Course:

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

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

Audience:

In addition to math majors, there will be students from CIS, education, and miscellaneous Arts and Sciences majors.

Background and Attitude of Audience:

The mathematical background and ability of the students varies through a wide spectrum. This nonuniformity creates some problems -- but all students seem to benefit from the course.

Text:

Kenneth Bigart: Introductory Combinatorics.

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Suggested Course Content:

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

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

3. Combinatorial designs: Latin squares, magic squares, finite geometries, difference sets, Steiner triple systems.

4. Matching theory: bipartite graphs, Konig's Theorem, and the "Marriage Theorem", the assignment problem.

5. Elementary graph connectivity: paths, connectivity, cycles, cutsets, trees, Eulerian and Hamiltonian paths and circuits.

6. Graph coloring: planar graphs and the Euler characteristic, Five Color Theorem, chromatic polynomials.

7. Flows in networks: Maxflow-Mincut Theorem, transportation problems, Menger's Theorem.

Course Coordinator: N. Robertson
Summer, 1983

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Mathematics 576	5 cr.	Linear Algebra and Discrete Algebraic Structures I
Mathematics 577.01	5 cr.	Linear Algebra and Discrete Algebraic Structures II
Mathematics 577.02	5 cr.	Linear Algebra and Discrete Algebraic Structures II

Prerequisite. Mathematics 153 or permission of department.

Purpose of Courses:

These courses were intended primarily for CIS majors. The primary purpose of the sequence was to introduce the students to fundamental algebraic, logical, and combinatorial concepts in mathematics which are needed in upper division CIS courses. A secondary purpose was to acquaint the students with some applications of these concepts to computer science.

Note:

As part of a curriculum update, Autumn, 1983 by the CIS Department, Math 576 has been replaced by a two-course sequence 366 and 566. Math 577 has been replaced by 568 and 569, linear algebra. Math 576/577 will no longer be offered. CIS majors in the College of Engineering will be required to take 366, 568 and either 566 or 569.

CIS majors in the College of Arts and Sciences need only 366 and 568.

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Mathematics 578 5 cr. Discrete Mathematical Models

(W) change to Autumn Qtr.

Recommended prerequisites:

568; 531 or Stat 425 or equivalent; and CIS 221

Catalog description:

Analysis and solution of various applied problems using discrete mathematical models. Methods used include: Graph Theory, Linear Optimization, Markov Chains and Queues.

Purpose of course:

To make available a course in constructing mathematical models of applied problems, using the methods of discrete mathematics, for mathematics majors, education majors, and students in actuarial science, computer science and the social sciences, and other students with interest in the application of mathematics.

Audience:

See Purpose of course.

Possible texts:

D. Maki and M. Thompson, Mathematical Models and Applications

Suggested course content:

I. General Overview
   - A. Principles of model construction
   - B. Practical aspects of model building and simulation
   - C. Selected examples

II. Graphs and Directed Graphs
   - A. Basic definitions and properties of graphs
   - B. Analysis of traffic patterns
   - C. Scheduling problems
   - D. Assignment and transportation problems

III. Linear Optimization
   - A. Models of health care and business
   - B. Linear inequalities and linear programming techniques (Simplex Method)
   - C. Applications of linear programming

IV. Markov Chains and Queues
   - A. Small group decision making models
   - B. Regular and ergodic chains, absorbing chains
   - C. Elementary survey of problems in queuing theory

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Course coordinator: T. Ralley
Autumn, 1983

Mathematics 580, 581, 582 3 cr. each Three Quarter Algebraic Sequence

A : Math 580
W : Math 581
Sp: Math 582

Prerequisite:

Math 568 may be taken concurrently with 580.

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:

This sequence permits students to study topics of number theory, linear algebra, and algebraic structures in a unified and integrated way.

Audience:

The audience is primarily junior and senior majors in mathematics and mathematics education. Sometimes a few students will develop especially well and we have added small seminars to the course for these students in the winter and/or spring quarters. Instructors need to watch for students who should be moved to H590 early in autumn quarter.

Possible Text:

McCoy, Goldstein, Dean, Paley and Weichsel, Fraleigh.

Suggested Course Content:

This course does not follow a syllabus. Each instructor can develop the topics according to his own preference. When there are two or more sections, instructors are asked to coordinate the content between sections. Instructors are also urged to put heavy emphasis on problem solving.

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The following list of topics can be regarded as the core of the course:

Elementary Number Theory: arithmetic of rational integers, divisibility, primes, Euclidean algorithm, congruences, groups of units; analogous theory in polynomials rings and Gaussian integers.

Elementary Group Theory: permutation groups, dihedral groups, cyclic groups; subgroups, cosets, LaGrange Theorem, normal subgroups, quotient groups, homomorphisms and isomorphisms.

Linear Algebra: independence, basis, subspaces, linear transformations, inner products, orthogonal transformations, matrices and determinants, similarity, systems of linear equations and algorithmic methods of solution, eigenvalues and vectors.

Field Theory: complex numbers, algebraic number fields; finite fields; ruler and compass constructions; field automorphisms.

In addition to the core, one or more of the above areas may be investigated in greater detail. Examples of how this has been done follow. Some of these topics have also been used for added seminars:

Foundations: relations, equivalence relations, order relations, functions and their algebraic properties, transfinite arithmetic.

Elementary Number Theory: linear Diophantine equations, Chinese Remainder Theorem, continued fractions.

Rings and Ideal Theory: Euclidean domains, principal ideal domains, unique factorization domains.

Linear Algebra: quotient spaces, Jordan canonical form, spectral theory, quadratic forms, quadric surfaces in R^2 and R^3, linear programming, multi-linear algebra.

Field Theory: Galois Theory.

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Course Coordinator: Joan Leitzel
Summer, 1983

Mathematics H590, H591, H592
5 cr. - H590; 3 cr. - H591, H592
A, W, Sp

Algebraic Structures I, II, III

Prerequisites:

H590: 290 or equivalent with permission of department. Grade of at least "B" in prior honors mathematics courses.
The content of 580, 581, 582 is contained in H590, H591, H592

Catalog Description:

Integers, congruence relations, structure preserving maps, topics dealing with groups, rings, modules, vector spaces and fields.

Audience:

The students are our strongest undergraduates. They will have had some prior exposure to formal argument and proof. This sequence continues the axiomatic development of mathematics and provides a general framework for students to grasp essential algebraic concepts. Problems and examples are emphasized.

Follow-up Courses:

Graduate level courses in mathematics.

Possible Texts:

Herstein: Topics in Algebra (Xerox);

Jacobson and Blaisdell: Basic Algebra;

Birkhoff and MacLane: A Survey of Modern Algebra, 4th Edition, (MacMillan).

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Suggested Course Content (not necessarily in order of coverage):

H590

1. Integers, unique factorization; congruences, Euler function; Chinese Remainder Theorem.

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 groups; solvable and simple groups.

3. Rings, subrings, ideals, morphisms, polynomials rings, prime and maximal ideals, finite fields.

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; order ideals; fundamental theorem for modules over principal ideal domains.

3. Vector spaces (as special case of modules); linear maps and matrices, canonical forms; dual spaces.

4. Multilinear algebra and the theory of determinants.

H592

1. Bilinear and quadratic forms; inner product and unitary spaces; principal axis theorem; relation to geometry.

2. Fields, extensions, algebraic and transcendental, 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: Harry Allen
Summer, 1983

re: 648 prereq: Dr Friedman said: 9/20/84

Mathematical sophistication rather than specific course content is the pre-req. He mentioned that he once had an exceptional freshman in his class who did quite well. For more run-of-the-mill students, he recommends the 580 sequence and the 547 sequence as a prereq. Such students should have previous exposure to ~~alg~~ rings, groups, δ-ε proofs, etc. However, very sophisticated, exceptional students can handle 648 without this previous exposure.

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