Department of Mathematics
The Ohio State University

1982-1983 Mathematics Courses

Course Number	Course Title
50	Introduction to College Mathematics
102	Basic College Mathematics
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
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
190H	Elementary Analysis
191H	Elementary Analysis
293HX	Elementary Analysis
221	Elements of Calculus III
255	Differential Equations and Their Applications
256	Differential Equations with Applications
290H	Linear Algebra and Multivariable Calculus
291H	Linear Algebra and Multivariable Calculus
292H	Linear Algebra and Multivariable Calculus
345	Foundations of Higher Mathematics

Course Number	Course Title
415	Ordinary and Partial Differential Equations
416	Vector Analysis and Complex Variables
471	Matrices and Linear Algebra
501	Fundamentals of Mathematics
502	Fundamentals of Mathematics
503	Fundamentals of Mathematics
504	The 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
559	Topology
560	Topology
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
580	Three Quarter Algebraic Sequence
581	Three Quarter Algebraic Sequence
582	Three Quarter Algebraic Sequence
590H	Algebraic Structures I
591H	Algebraic Structures II
592H	Algebraic Structures III

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

Credit may not count toward graduation in some degree programs.

Prerequisite:

Level 5 Math placement on OSU Placement Test.

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 Math Placement Level 5. The course will prepare students for 102.

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.

Follow-up Courses:

Math 102

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Syllabus for Math 050

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 equation

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

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
    circles
    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, 1982

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

Prerequisite:

Level 4 Math placement 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 Math Placement Level 4 or with credit for 050. It prepares students for Math 105, 116, 130, and 148.

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.

Follow-up Courses:

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).
Math 148 for students in a science, ag. sciences, math, engineering or computer science curriculum.

Syllabus for Math 102

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 and division

6. Factoring -- common monomial factor
   quadratics
   by grouping

7. Solving quadratic equations -- by factoring
   use of quadratic formula
   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

Course Coordinator: N. Robertson

Summer, 1982

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

Prerequisites:

Level III placement 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 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 courses:

Mathematics 106

Course content:

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

Course coordinator: Jim Schultz
Tom Dowling

Summer, 1982

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Mathematics 106 5 cr. Mathematics for Elementary Teachers II
Au, SP, S

Prerequisites:

Mathematics 105

Follow-up courses:

Mathematics 107

Course content:

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

Course coordinator: Tom Dowling
Jim Schultz

Summer, 1982

Mathematics 107 5 cr. Mathematics for Elementary Teachers III
Sp

Prerequisites:

Mathematics 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 coordinator: Tom Dowling
Jim Schultz

Summer, 1982

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

Recommended Prerequisites:

Math 102 or Math Placement Level III

Catalog 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. Alternately, 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(s):

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, 2-6, 2-7	Exponential, log	5
5-1, 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

Course Coordinator: Jack Tull
Summer, 1982

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

Recommended prerequisites:

Mathematics 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 221 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 120.

Text:

College Mathematics for Management, Life and Social Sciences, 2nd edition, Barnett; 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 + 5
12-1 thru 12-5	Exponential and log	3 + 3
12-7	Improper integrals	3
13-1 thru 13-3	Several variables	5

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Course Coordinator: Jack Tull
Summer, 1982

Mathematics 130 Elements of Algebra

Su, S, W, Sp 4 cr.

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Prerequisites:

Placement Level 3 or Math 102

Catalogue 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 problems from economics.

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, 3rd Edition (Reston)

Syllabus: (16 lectures, 3 exams)

	Topics (Text, Chapter-Section)	
1.	Exponents and Radicals, Operations with Fractions	(0.5,6,7,8)
2.	Linear Equations and Rational Equations	(1-1,2)
3.	Quadratic Equations; Applications	(1-3,2-1)
4.	Inequalities and Applications	(2-2,3,4)
	EXAM I	
5.	Functions and Graphs	(3-1,2,3)

Syllabus (Continued)

7.	Systems of Equations	(4-3,4-4)
8.	Applications of Linear Equations	(4-5)
9.	Exponential Functions	(5-1)
10.	Logarithmic Functions	(5-1,2)
	EXAM II	
11.	Compound Interest	(6-1)
12.	Annuities-Amortization of Loans	(6-2,6-3,6-4)
13.	Matrix Algebra	(15-1,2,3)
14.	Reduction of Matrices	(15-4)
15.	Same	(15-5)
	EXAM III	
16.	Inverses, and (or) Determinants and Cramer's Rule	(15.6)

Course Coordinator: Monique Vuilleumier

Summer 1982

Mathematics 131 Elements of Calculus I

A, W, Sp, Su 4 cr.

Recommended Prerequisites:

Math 130 or 150 or OSU Math Placement Level I.

Catalog Description:

Limits, tangent lines, continuity, differentiability, mean value theorem, graphing techniques, sequences, Taylor's theorem, definite integral, fundamental theorem of calculus, 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 132.

Possible Text:

Haeussler and Paul: Introductory Mathematical Analysis, 3rd Edition (Reston).

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Syllabus: (Topics, Chapter-Section)

1.	Limits	(7-1, 7-2)
2.	Interest Compounded Continuously	(7-3)
	Continuity	(7-4)
3.	Continuity Applied to Inequalities	(7-5)
4.	Derivatives	(8-1)
5.	Rules for Differentiations	(8-2)
	Derivative as a Rate of Change	(8-3)
6.	Differentiability and Continuity	(8-4)
	Product and Quotient Rule	(8-5)
7.	Chain Rule and Power Rule	(8-6)
	Higher Order Derivatives	(8-11)
8.	Derivatives of Logarithmic Functions	(8-7)
	Derivatives of Exponential Functions	(8-8)
9.	Implicit Differentiation	(8-9)
	Logarithmic Differentiation	(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	(9-7) Optional
	Elasticity	(9-8) Optional

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Course Coordinator: Surinder Sehgal

Summer 1982

Mathematics 132 Elements of Calculus II

A, W, Sp, Su 4 cr.

Recommended Prerequisites:

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 221

Possible Text:

Haeussler and Paul: Introductory Mathematical Analysis, 3rd Edition (Reston).

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Syllabus: (Topics, Chapter-Section)

1.	Indefinite Integral	(10-1)
	Integration Formulas	(10-2)
2.	Techniques of Integration	(10-3)
3.	Summation	(10-4)
	Definite Integral	(10-5)
	Fundamental Theorem	(10-6)
4.	Area	(10-7)
	Area Between Curves	(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	(12-3)
	Higher-Order Partials	(12-5)
13.	Maxima and Minima	(12-7)
14.	Lagrange Multipliers	(12-8)

Course Coordinator: Bob Gold

Summer 1982

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

Recommended prerequisites:

OSU Math Placement Level 3A or above or Math 102

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,...). 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 Mathematics and Physical Sciences generally take this course. Some majors in the College of Agriculutre, 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

Text:

Hestenes and Hill: Algebra and Trigonometry with Calculators

Course Contents:

Chapters 1 through 4 and parts of 6, 10, and 11 of the text.

Exponents and radicals	(1.2 and 1.7)
Equations and inequalities	(2.4 - 2.7)
Functions	(3.1 - 3.4)
Polynomial functions, rational functions, conic sections	(4.1 - 4.4)
Systems of equations	(6.1)
Complex roots of equations	(10.1, 10.2)
Zeros of polynomials, properties of division	(11.1)

Course Coordinator: Bert Waits
Summer, 1982

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

Recommended prerequisites:

OSU Math Placement Level 2A 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 needed by the student entering the regular calculus sequence (151, 152,...) 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. Students should be placed in Math 150 only if they have a strong algebra background and are well motivated.

Follow-up courses:

Math 151

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Text:

Hestenes and Hill: Algebra and Trigonometry with Calculators

Syllabus:

Sections 3.3, 3.4, 3.7	Relations, Functions, Graphs
Chapter 5.1 - 5.6	Exponential and Logarithmic Functions
Chapter 7.1 - 7.4	Right Triangle Trigonometry
Chapter 8.1 - 8.7	General Trigonometry
Chapter 9.1 - 9.7	Analytic Trigonometry
Chapter 10.1 - 10.4	Complex Numbers

Course Coordinator: Bert Waits
Summer, 1982

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Mathematics 151, 152 5 cr. Differential and Integral Calculus
A, W, Sp, Su

Prerequisites:

Math Placement 1 or 150.

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:

Calculus with Analytic Geometry, 2nd Edition, Ellis and Gulick, (to be introduced for 151 Autumn, 1982)

Course coordinator: Frank Carroll
Summer, 1982

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

Mathematics H263 or H263C — 5 cr. Calculus

H151, H151C - A
H152, H152C - W
H263, H263C - Sp

The Honors courses are accelerated versions of the regular sequence in calculus. They are designed to challenge well prepared, highly motivated students irrespective 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 computation with programmable calculators in teaching the honors syllabus.

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.

Although completion of this sequence 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:

H263:

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

H151, H151C:

Differential calculus of one variable through Beries and sequences

H152, H152C:

Integral calculus of one variable

Text:

Ellis and Gulick, 2nd Edition, Calculus with Analytic Geometry to be used beginning Autumn 1982 for H151.

Course Coordinator: H. Allen

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

Prerequisites:

Math 152

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

Indeterminant forms, L'Hospital's rule, improper integrals. Sequences and series, Taylor's formula with remainder, power series. Vector calculus, line and surface integrals, Green's Theorem, vector fields.

Text:

Calculus with Analytic Geometry by Ellis and Gulick, 2nd Edition

Course coordinator: Ted Scheick
Summer, 1981

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Mathematics 180 5 cr. Insights into Mathematics
S, A, W, Sp

Prerequisite:

Sophomore standing or permission of department.

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 courses for the purpose of satisfying a graduation requirement but with no need for specific problem solving skills. The courses that have been used by such students in the part are skill oriented rather than liberal arts type courses. This course is one that emphasizes involvement with 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 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 Colleges of Arts and Sciences and students from the College of Education who must meet a 5 hour mathematics certification requirement.

Course Coordinator:
Summer, 1982

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THE OHIO STATE UNIVERSITY
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Mathematics H190, H191, H293X Elementary Analysis

H190 - A 5 Cr.
H191 - W 5 Cr.
H263 - Sp 5 Cr.

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-H194:

Properties of real numbers. Mathematical Induction. Definition of integral. Integrals of polynomials and trig functions. Applications. Continuity, limits, derivative and applications. Fundamental theorem and integrations techniques. Taylor series. Some 1st order differential equations. Complex number field. Sequences and series of numbers and functions. Uniform convergence. Power series. Functions of several variables. Vectors.

H263X

Same as previous page for H263

Text:

Apostol, Calculus, Volume I

Note: It has been the practice to have a separate section of H263 in spring continuing the H190-191 sequence. The content is similar to that of the other H263 sections but the treatment is more rigorous.

Text:

Apostol, Calculus, Volume II, Chapters 8-12

Course Coordinator: H. Allen
Summer, 1982

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

Mathematics 221 5 cr. Elements of Calculus III
A, Sp

Prerequisites:

Math 132 or equivalent with written permission of the Department.

Catalog Description:

A continuation of Math 132. Topics in calculus.

Purpose of Course:

(a) To prepare the student for Statistics 425.

(b) To prepare the student for additional work in mathematics.

Audience:

Generally Math-Stat or CIS majors in the College of Administrative Science.

Follow-up Courses:

Math 471, Statistics 425.

Possible Text(s):

See the Course Coordinator.

Suggested Course Content:

See the Course Coordinator.

Course Coordinator: Bert Waits
Summer, 1982

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

Recommended prerequisites:

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. Students after this course 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 Systems of First Order Linear Equations.

Text:

A First Course in Differential Equations with Applications by Dennis Zill

*This will be taught if time is allowed.

Course Coordinator: Y. C. Lu
Summer, 1982

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

Recommended prerequisites:

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:

A Short Course in Differential Equations, Rainville and Bedient

Introduction to Ordinary Differential Equations, A. L. Rabenstein

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.

(OVER)

Suggested Outline I (from Rainville and Bedient)

Chapter 2, Sections 5-12	5 days
Chapter 3, Sections 13-15	3 days
Chapter 5, Sections 24-29	2 days
Chapter 6, Sections 33-37	2 days
Chapter 7, Sections 38-41	1 day
Chapter 8, Sections 44-45	1 day
Chapter 12, Sections 67-70	3 days
Chapter 13, Sections 71-79	7 days
Chapter 14, Sections 81-82	2 days
Supplementary Applications	2 days
Review before tests	9 days
Tests	3 days
	40 days

Suggested Outline II (from Rabenstein)

Chapter 1. Introduction to Differential Equations (all sections)
Appendices A1, A2, A3, A4, and matrix multiplication
Chapter 2. Linear Differential Equations, Sections 1-12
Chapter 8. Systems of Differential equations (all sections)

Course Coordinator: Frank Carroll
Summer, 1982

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. In recent years, the course has included.

Course Coordinator: H. Allen
Summer, 1982

DEPARTMENT OF MATHEMATICS
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Mathematics 345 — Foundations of Higher Mathematics

A., Sp. 4 Cr.

DEPARTMENT OF MATHEMATICS
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Recommended prerequisites:

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:

Sentilles: A Bridge to Advanced Mathematics

Suggested course content: Topics include: (not necessarily in order of coverage)

1. Introduction to logic, including proof techniques: indirect proof, direct proof, mathematical induction.
2. Basic Set theory
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)

Course Coordinator: Bob Gold
Summer, 1982

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

Recommended prerequisites:

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 trigonometry series, and separation of variables in Partial Differential Equations. It is a combination of 255 (Differential Equations) and 512 (Fourier Series and Boundary Value Problems).

Audience:

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

Background and attitude of audience:

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

Possible text(s):

Boyce and DePrima, Differential Equations

Suggested course content:

Using Boyce and DePrima:

Section Numbers	Days Spent
1.1, 1.2, 2.1-2.7	7
3.1 - 3.62	10
4.1 - 4.7	10
10.1 - 10.8	13
11.1 - 11.6	5
Optional Material	3 - 5 Systems

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Course coordinator: Frank Carroll
Summer, 1982

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

Recommended prerequisites:

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 text(s):

Vector Analysis, Schaum's Outline

Complex Variables, Churchill, Brown, and Verhey

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Suggested course content:

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

Suggested Schedule:

Vector analysis -- 15 classes including test

Complex variables -- 15 classes including test

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

   Schedule:

   Chap. 1-4 -- 4 classes -- treat as review

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

   Chap. 9 -- 5 classes -- Gauss, Green, Stokes. Omit p. 107.

2. Schedule:

   Chap. 1 -- 3 classes
   Chap. 2 -- 4 classes
   Chap. 3 -- 4 classes
   TEST
   Chap. 4 -- 5 classes
   Chap. 5 -- 5 classes
   Chap. 6 -- 4 classes
   TEST
   Chap. 7 -- 6 classes

OVERALL COMMENT -- Run as a problem course. Minimal proofs.

Course coordinator: Frank Carroll
Summer, 1982

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

Recommended prerequisites:

Math 153 or 221 or equivalent with permission of department

Catalog description:

Not open to students with credit for 571, 568, or 576. 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 $290, 569, or 576. Further, emphasis is placed on the topics as tools rather than as development of structure; applications are chosen from Markov processes and 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 applications 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:

Mimeographed notes by B. Wyman will be available from Kinko's.

Suggested course content:

matrices - arithmetic, inverse, transpose, rank;
systems of equations - homogeneous and nonhomogeneous;
vector spaces - R^n, independence, spanning sets, basis;
determinants - elementary properties, cofactors;
Linear Programming
Eigenvalues and Eigenvectors;
Markov chains and Difference equations

Course Coordinator: Bostwick Wyman
Summer, 1982

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Mathematics 501, 502, 503 Fundamentals of Mathematics I

501 - A.	4 Cr.
502 - W.	4 Cr.
503 - Sp.	4 Cr.

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:

It 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, derivatives, limits, mean-value theorem; applications of derivatives to curve sketching, maxima and minima, approximations; antidifferentiation, the definite integral, fundamental theorem of calculus; area, volume, other applications of integration; inverse functions, logarithmic, exponential, trigonometric, inverse trigonometric, and hyperbolic functions; integration techniques, indeterminate forms; improper integrals; Taylor's formula; infinite series, differential calculus of functions of several variables; multiple integration.

Course coordinator: Archie Addison

Summer, 1982

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Mathematics 504 5 cr. The History of Mathematics
A, Sp

Recommended prerequisites:

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

Follow-up courses:

This course is terminal.

Possible texts:

Howard Eves: An Introduction to the History of Mathematics, 4th ed., (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: A * means that this must be included in the course.)

1) *reading: (1) Eves of some other general history on mathematics
(2) at least 2 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, 1982

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Mathematics 507 5 cr. Advanced Geometry
A, W

Recommended prerequisites;

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 Education College 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:

Geometry by Transformations, by E. A. Maxwell, Cambridge U. press.

Suggested Course Content:

* Review of high school geometry

* Euclidean motions and similarities

(Circular Inversion, or if there is enough time left)

Finite Geometries

Course Coordinator: Arno Cronheim
Summer, 1982

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Mathematics 512

Partial Differential Equations
and Boundary Value Problems

A., W. 5 Cr.

Recommended prerequisites:

255 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 text(s):

1. Kreyszig, Advanced Engineering Mathematics, Wiley.

   This book contains most of the material needed, and much more. It is a good reference book for engineers to own, especially if they intend to take further mathematics courses. It can also be used for 513 and 514.

3. a) Miller, Partial Differential Equations in Engineering Problems, Prentice Hall.

   b) Rainville, The Laplace Transform, McMillan.

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.

OVER

Math 512 Partial Differential Equations and Boundary Value Problems

Suggested Syllabus:

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, eg. Complex Fourier Series, double Fourier series.

   Kreszig - Chapter 9, Sections 9.1 to 9.5. 9.7 and 9.8 optional.

   Miller - Sections 15 to 40, except 20, 21, 27, 28, 34, 35, 38, 39.

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 equation; 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.
   Kreszig - Chapter 10, Sections 10.1, 10.3, 10.4, 10.5. Skimpy on Laplace's equation.

   Miller - Sections 42, 43, 45, 47, 49, 53.

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.

   Kreszig - Chapter 4, Sections 4.1 to 4.9.

   Rainville: Chapters 1, 2, 3, 4.

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: J. T. Scheick

Summer, 1982

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Mathematics 513 Vector Analysis for Engineers

W. 3 cr.

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Recommended prerequisites:

Calculus and differential equations.

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 text(s):

Vector Calculus - Lindgren

Advanced Engineering Mathematics - Kreyszig, chapters 7, 8. This is also a good general reference book for engineers. It can also be used for 512, 514.

Suggested course content:

From Lindgren: Level of text is about right. Supplementary problems (e.g., Vector Calculus--Schaums) will be needed.

Suggested Schedule:

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

Course coordinator: J. T. Scheick

Summer, 1982

Mathematics 514 Complex Variables for Engineers

Sp. 3 cr.

Recommended prerequisites:

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 text(s):

1. Churchill, Complex Variable and Applications (a bit hard to read for students)

2. Smith, Elementary Complex Variables, Merrill

3. Kreyzig, 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:

1.	Complex Numbers, polar form	3 days
2.	Analyticity, Cauchy-Riemann Eq.	3 days
3.	Elementary Functions	4 days
		Test
4.	Mapping by elementary functions	3 days
5.	Cauchy integral Theorem and consequences	5 days
		Test
6.	Power series	3 days
7.	Residues, definite integrals	6 days

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

11.	Complex Analytic Functions	9 days
12.	Conformal Mapping (omit 12.6)	4 days
13.	Complex Integrals	5 days
14.	Sequences, Series (Just state definitions and the theorems on power series)	1/2 day
15.	Taylor and Laurent Series	2 1/2 days
16.	Integration by Residues	6 days
17.	Complex functions and Potential Theory: only if you have some time left over and the students are well versed with the above material	

Course coordinator: J. T. Scheick
Summer, 1982

Mathematics 530 A — 3 cr. — Probability I

Recommended prerequisites:

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 courses:

Mathematics 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

Course Coordinator: Louis Sucheston
Summer, 1982

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Mathematics 531 3 cr. Probability II
W

Recommended prerequisites:

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

Course Coordinator: Louis Sucheston
Summer, 1982

DEPARTMENT OF MATHEMATICS
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Mathematics 547 Introductory Analysis I

Su, A. W. 3 cr.

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Recommended prerequisites:

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.

Follow-up courses:

548, 549

Possible text(s):

Avner Friedman
Watson Fulks
Anthony Labarre

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 of coverage)

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.

Course coordinator: David Dean

Summer, 1982

Mathematics 548 Introductory Analysis II

Su., W., Sp. 3 cr.

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Recommended prerequisites:

547 or permission of instructor

Catalog description:

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

Audience:

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

Follow-up courses:

549 or 551 or 552.

Possible text(s):

Avner Friedman
Watson Fulks
Anthony Labarre

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.

Course coordinator: David Dean

Summer, 1982

Mathematics 549 Introductory Analysis III

Sp. 3 cr.

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Recommended prerequisites:

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:

551 or 552

Possible text(s):

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 variation 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.

Course coordinator: David Dean

Summer, 1982

Mathematics 551 Vector Analysis

Au., Sp. 5 cr.

Recommended prerequisites:

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 space. Applications in geometry should be emphasized. This course is not open to students with credit for 513, 551.01, or 551.02.

Possible texts:

Kaplan - Advanced Calculus, with supporting problems from Schaum's.

Suggested Course content:

Partial differentiation - Transformations of variables, vector algebra and vector calculus for curves, vector differential operators, line and surface integrals, Theorems of Stokes, Green, and the divergence theorem. Emphasis on techniques and calculations.

Course coordinator: David Dean
Summer 1982

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Mathematics 552 5 cr. Complex Variables I
Su, W

Recommended prerequisites:

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 8 chapters of Churchill. The fact that it is a 5 hour course permits more depth than is possible in, say 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 grad students.

Background and attitude of audience are good.

Follow-up courses:

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

Possible text:

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: F. W. Carroll
Summer, 1982

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231 WEST EIGHTEENTH AVENUE
COLUMBUS, OHIO 43210-1174

Mathematics 556 3 cr. Differential Equations
A, Sp

Recommended prerequisite:

Mathematics 254

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) 1st and 2nd order linear differential equations (2) Series 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 converngence 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.

Course Coordinator: Y. C. Lu
Summer, 1982

DEPARTMENT OF MATHEMATICS
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Mathematics 557 3 cr.
W

Recommended Prerequisites:

Math 556

Course Objectives:

This is a continuation of the course 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 solution.

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, 1982

DEPARTMENT OF MATHEMATICS
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Mathematics 559 3 cr. Topology
W

Prerequisites:

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, 1982

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Mathematics 560 3 cr. Topology
Sp

Prerequisites:

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 text(s):

(1)	Undergraduate Topology	Kasriel
(2)	Elementary General Topology	Moore
(3)	Elementary Topology	Gemignani
(4)	Foundations of General Topology	Pervin

Suggested course content:

The catalog description is accurate.

Course Coordinator: Norman Levine
Summer,1982

DEPARTMENT OF MATHEMATICS
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Mathematics 568 Linear Algebra I

Su., A., W., Sp. 3 cr.

Recommended prerequisites:

153 or permission of department
Not open to students with credit for 471 or 576.

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.

Audience:

In the sequence 568 and 569, the emphasis is place on techniques and computational skills. The students would be predominately sophomores 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(s):

Elementary Linear Algebra, Shields, 3rd Edition.

(over)

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; independence; 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 $\mathbb{R}^n$; orthogonality and orthonormal bases.

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

Course Coordinator: Willie McWorter

Summer 1982

Mathematics 569 Linear Algebra II

Su., W., Sp. 3 cr.

Recommended prerequisites:

568 or permission of department
Not open to students with credit for 471 or 576.

Catalog description:

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

Audience:

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

Follow-up courses:

Any course having a linear algebra prerequisite.

Possible text(s):

Elementary Linear Algebra, Shields; 3rd Edition.

(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; diagonalization of matrix.

6. Symmetric matrices; inner products and quadratic forms.

7. Principal Axis theorem (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, 1982

DEPARTMENT OF MATHEMATICS
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Mathematics 573 5 cr. Elementary Number Theory
W

Recommended prerequisites:

Sophomore standing

Catalog description:

Utilization of concrete examples to introduce concepts of modern algebra; prime numbers, congruences, Dipphantine 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; to develop reasonable facility in the student of proof formulation.

Audience:

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

Possible text:

Niven and Zuckerman: An Introduction to Theory of Numbers (3rd Edition)

Suggested course content: (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.

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 1982

DEPARTMENT OF MATHEMATICS
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Mathematics 574 5 cr. Geometry
A

Prerequisites:

Permission of instructor, or some linear algebra. (In the future, a 3-hour sophomore linear algebra would be appropriate.)

Catalog description:

Euclidean and non-Euclidean geometry, emphasizing algebraic connections; affine and projective planes, duality. Additional topics: finite planes, HILBERT's postulates.

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.

Text:

Fishback, Projective and Euclidean geometry, (John Wiley and Sons).

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 .

Course coordinator: Arno Cronheim
Summer, 1982

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

Recommended prerequisites:

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 tool.s

Audience:

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

Background and attitude or 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.

Present text:

Introductory Combinatorics, R. A. Brualdi

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: Tom Dowling
Summer, 1982

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2nd yr. of 2 yr. experiment putting discrete math into 576 + deleting lin. alg.

Mathematics 576 5 cr. Linear Algebra and Discrete Algebraic Structures I
A, W, Sp

Note: The linear algebra segment of 576/577 has been shifted to 577.

Proposeed catalog description:

Sets, mappings, and relations; elementary counting principles; mathematical induction; graphs and directed graphs; semigroups and groups; boolean algebras; applications to computer science.

Present catalog description:

Linear algebra (vector spaces, linear maps, matrices, systems of equations) and in roduction to discrete and finite algebraic structures with applications to computer and information science.

Purpose of course:

This course is intended primarily for CIS majors. The primary purpose of the course is to introduce the student to fundamental algebraic, logical, and combinatorial concepts in mathematicswhich are needed in upper division CIS courses. A secondary purpose is to acquaint the student with some applications of these concepts to computer science.

Audience:

The students are upper level undergraduates with the exception of a few beginning graduate students. All have taken at least Math 254, but few have any background in algebra.

Background and attitude of audience:

With a few exceptions each quarter, the mathematical sophistication of the audience is quite low. They fare much better with computational exercises than with proofs and exercises which test understanding of concepts, but it is important that they be exposed to and attempt formal proofs to some extent. Reference to various applications of the material to computer science helps to motivate the students and maintain their interest, but Math 576 should be considered an honest mathematics course.

Follow-up courses:

CIS majors in the College of Engineering will likely take a linear algebra course, either Math 577 or Math 568/9, although Math 576 is not a prerequisite for these. CIS majors in the College of Arts and Sciences will not likely take any further mathematics courses.

Possible text:

The text used in 1981/2 is being replaced, probably by:

F. Preparata and R. Yeh, Introduction to Discrete Structures, Addison-Wesley, 1973.

Suggested course content:

Formal systems, logical deduction, and mathematical induction. Sets, binary relations between sets, mappings, relations on a set, equivalence relations and partitions. Elementary counting principles and recurrence relations.

Directed graphs, reachability and strong connectedness. Undirected graphs, trees, planar graphs, and path problems.

Binary operations. Semigroups, monoids, and groups. Isomorphisms, congruences, and homomorphisms.

Partial orders and lattices, with emphasis on distributive lattices and boolean algebras. Boolean functions.

At the end of each chapter, the suggested text describes numerous applications from which the instructor may select topics to the extent that time and his/her interest permits.

Course Coordinator: Tom Dowling
Summer, 1982

Mathematics 577.01

Linear Algebra and Discrete Algebraic Structures

W.,S. 5 cr.

Recommended prerequisites:

Math 576

Catalog description:

A continuation of 576.

Purpose of course:

This course is intended primarily for CIS majors. The purpose of this course and its prerequisite 576 is to provide a foundation in linear algebra and discrete structures. This is important for all CIS students and would be essential, in particular, for those desiring to go on to graduate studies.

The course has been designed with input from the CIS faculty, and it is their wish that it be an honest algebra course. But topics are chosen with the audience in mind, and relevancies to computing are pointed out as they arise.

Audience:

The students are upper level undergraduates with the exception of a few beginning graduate students. All have taken at least Math 254, but have no background in algebra.

Background and attitude of audience:

With several notable exceptions each quarter, the mathematical sophistication of the audience is poor. It is necessary (and desirable) to choose the subject matter and problems carefully to exploit their talents and keep their interest. They will work hard and are always interested in learning how to do things. Communication is a problem - the students do not speak our algebraic language. However, in the end, the majority of students seem to appreciate the course.

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(over)

Possible text(s):

The present texts for the sequence 576-577.01 are

1. Schaum's Outline "Linear Algebra."

2. Lindsay Childs, "A Concrete Introduction to Higher Algebra."

These need to be augmented with notes on primitive elements, polynomial congruences, and error-correcting codes.

Suggested course content:

I. Continuation of linear algebra from 576.

Transformations and the algebra of matrices. Orthogonal projections and curve fitting. Determinants, eigenvalues, diagonalization, and linear recursions. Canonical forms.

II. Groups.

Groups of permutations, Cayley graphs. Lagrange's Theorem. Groups of units modulo n and primitive elements modulo p.

III. Polynomial rings.

Roots, rational roots. Divisibility and the Euclidean algorithm. Congruences and factor rings. Finite fields and polynomial codes.

Course coordinator: Tom Dowling

Summer 1982

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Mathematics 577 5 cr. Linear Algebra and Discrete Algebraic Structures II

Note: The discrete structures component of 577 has been shifted to 576.

Proposed Catalog Description:

Matrices and linear equations; subspaces, bases, and dimension; determinants; vector spaces and linear transformations; eigenvalues, eigenvectors, and diagonalization; applications to error-correcting codes.

Present catalog description:

A continuation of 576.

Purpose of course:

This course is intended primarily for CIS majors in the College of Engineering who need a second upper division mathematics course in addition to Math 576. The content of the course is comparable to that of Math 568 and much of Math 569, with some treatment here of vector spaces over the finite fields Z/pZ. The primary purpose of the course is to introduce the student to the fundamental concepts and techniquesof linear algebra. A secondary purpose is to acquaint the student with some applications of the material to computer science.

Audience:

The students are upper level undergraduates with the exception of a few beginning graduate students. All have taken at least Math 254, but few have any background in algebra.

Background and attitude of audience:

With a few exceptions each quarter, the mathematical sophistication of the audience is quite low. They fare much better with computational exercises than with proofs and exercises which test understanding of concepts, but it is important that they be exposed to and attempt formal proofs to some extent. Reference to various applications of the material to computer science helps to motivate the students and maintain their interest, buth Math 577 should be considered an honest mathematics course.

Follow-up courses:

CIS majors in Math 577 will likely have taken the discrete structures course (Math 576) earlier, but that course could follow 577. Neither Math 576 nor Math 577 should be considered a prerequisite for the other.

Text:

The text used in 1981/2 is the same as the Math 568/9 text:

L. Johnson and R. Riess, Introduction to Linear Algebra, Addison-Wesley, 1981.

Suggested course content:

Systems of linear equations, matrices, and Gaussian elimination; echelon matrices; matrix operations, linear independence, nonsingular matrices and matrix inverses.

The vector space Rn, subspaces, bases, and coordinates; linear transformations, matrix representations, change of basis, and diagonalization.

Linear error-correcting codes; parity check matrices and their relation to error correction; decoding methods.

Course coordinator: Tom Dowling
Spring, 1982

DEPARTMENT OF MATHEMATICS
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Mathematics 580, 581, 582 Three Quarter Algebra Sequence

580: A 3 credits
581: W 3 credits
582: Sp 3 credits

Prerequisites:

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 expecially 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. Teachers are also urged to put heavy emphasis on problem.

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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 polynomial 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

Course Coordinator: Joan Leitzel
Summer, 1982

DEPARTMENT OF MATHEMATICS
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Mathematics H590, H591, H592 Algebraic Structures I, II, III
A, W, Sp
5 cr - H590 ; 3 cr - H591, H592

Recommended Prerequisites:

H590: 290 or equivalent with permission of department.
The content of 580, 581, 582 is contained in H590, H591, H592

Catalog description:

Integers, congruence relations, structure preserving maps, topics from groups, rings, modules, vector spaces, 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:

Topics in Algebra, Herstein, Xerox

Basic Algebra, Jacobson, Freeman

A Survey of Modern Algebra, 4th, Birkhoff and MacLane, MacMillan

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, polynomial rings, prime and maximal ideals, finite fields.

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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 ofmodules); 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.

Prepared by: Jim Leitzel
Summer, 1982

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