Department of Mathematics
The Ohio State University

1976-1977 Mathematics Courses

Course Number	Course Title
100	Introduction to College Mathematics
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105	Mathematics for Elementary Teachers I
106	Mathematics for Elementary Teachers II
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116	Survey of College Algebra
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120.01	Fundamental Mathematics, Algebra
120.02	Fundamental Mathematics, Calculus I
122	Fundamental Mathematics II
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149	Trigonometry
150	Algebra and Trigonometry
151	Differential and Integral Calculus
152	Differential and Integral Calculus
151H	Calculus and Analytic Geometry
152H	Calculus and Analytic Geometry
263H	Calculus
153	Differential and Integral Calculus
254	Differential and Integral Calculus
180	Insights into Mathematics
190	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
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415	Ordinary and Partial Differential Equations
416	Vector Analysis and Complex Variables
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Course Number	Course Title
100	Introduction to College Mathematics
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
545	Mathematical Logic I
546	Mathematical Logic II
547	Introductory Analysis I
548	Introductory Analysis II
549	Introductory Analysis III
551.01	Vector Analysis
551.02	Advanced Calculus II
552.01	Complex Variables I
552.02	Complex Variables I
556	Differential Equations
557	Orthogonal Systems and Differential Equations
560	Topology
568	Linear Algebra I
569	Linear Algebra II
571	Introduction to Linear Algebra
573	Elementary Number Theory
574	Geometry
575	Combinatorial Mathematics & Graph Theory
576	Linear Algebra and Discrete Algebraic Structures
577.01	Linear Algebra and Discrete Algebraic Structures
577.02	Discrete Algebraic Structures
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 101.01 Basic Mathematics I

S., A., W., Sp. 3 cr.

Prerequisites:

Placement on basis of OSU Mathematics Placement Test or 100.

Catalog description:

Topics include: real numbers, their arithmetic; factoring, area, graphing, linear equalities and inequalities, absolute value, systems of linear equalities, fractional equations, quadratic equations, exponents, radicals.

Purpose of course:

The course is a review (on an advanced level) of elementary topics which are essential for success in college-level science and mathematics courses.

Purpose of dividing 101 into two courses, 101.01 and 101.02:

Both 101.01 and 101.02 may be covered in one quarter, with 5 class periods each week and 5 hours credit. In this case the student registers for both 101A01 and 101A02 in the same quarter. At a slower pace, 101.01 may be taken in one quarter, with 5 class periods and 3 hours credit, and 101.02 in another quarter with 3 class periods and 2 hours credit. In this case, the student registers for 101B01 one quarter and 101B02 the next quarter.

Audience:

Those students with Math Placement level III who will need 148 or 120 are assigned to 101. All level IV students are assigned to 101. (Students with Mathematics Placement Level V are automatically assigned to Math 100.) The typical 101 student has credit for two or three years of high school mathematics although some have less and some have more. We assume that all 101 students need at least a next mathematics course for their chosen majors (i.e. that they will move into 148, 120, 116 or 105). Students who place at the remedial level but who do not need mathematical skills for their majors can take Math 180.

Follow-up courses:

The next course is 101.02.

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(over)

Possible text(s):

Fraser, Elementary Algebra.

Course content:

Real number arithmetic, algebriac expressions, linear equations and inequalities, graphing equations and inequalities, systems of equations and inequalities, integer exponents, products.

Course coordinator: Joan Leitzel-101A
John Riner-101B

Spring, 1976

Mathematics 101.02 Basic Mathematics II

Su., A., W., Sp. 2 cr.

Prerequisites:

Math 101.01

Catalog description:

A continuation of 101.01

Possible text(s):

Fraser, Elementary Algebra.

Suggested course content:

Factoring, fractions, ratio and proportion, radicals and rational exponents, absolute value, quadratic equations.

Course coordinator: Joan Leitzel - 101A
John Riner - 101B

Spring, 1976

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Mathematic 105 Mathematics for Elementary Teachers I

W., Sp., Su. 5 Cr.

Recommended prerequisites:

Level III placement or Math 101

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 mathematic 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 -- 106

Course content

Basic concepts dealing with natural numbers, integers, rational numbers, combinatorial counting procedures, and elementary probability.

Course coordinator: Joe Ferrar

Spring, 1976

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Mathematics 106 Mathematics for Elementary Teachers II

Au., Sp., S. 5 cl.

Recommended prerequisites:

Mathematics 105

Follow-up courses -- 107

Course content:

Elementary intuitive geometry, linear measurement, real numbers, area and volume measure, angle measurement, introduction to axiomatic geometry, geometric constructions.

Course coordinator: Joe Ferrar

Spring, 1976

Mathematics 107 — Mathematics for Elementary Teachers III

Sp. 5 Cl.

Recommended prerequisites:

Mathematics 106

Catalog description:

Further topics in mathematics selected by the instructor to broaden the mathematical 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: Joe Ferrar

Spring, 1976

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Mathematics 116 Survey of College Algebra

Su., A., W., Sp. 5 cl.

Recommended prerequisites:

Math 101 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, linear programming and graph theory.

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.

Follow-up courses:

Students may elect 117 to complete the ASC 10 hour requirement for Skills and Understandings of Analysis and Interpretation: Symbolic Communication.

Note: Students may also elect 116 and any course from CIS or Statistics or Philosophy 150, 250, 650, 653, and 674 or Math 180.

(over)

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Possible text(s):

An Introduction to Calculus with Economic Applications

Suggested course content:

I	Notation and Functions Set Language Properties of Functions	6 days
II	Algebra Axioms and Properties of Real Numbers Inequalities Absolute Value Equations	9 days
III	Graphing Subsets of R^2 Inequalities Absolute Value Equations	5 days
IV	Vectors R^2 Lines Slope	10 days
V	Linear Algebra Matrix Theory Linear Transformations	13 days
VI	Linear Programming	3 days

Course coordinator: John Riner

Spring, 1976

Mathematics 117 Survey of Calculus

Su., A., W., Sp. 5 cl.

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.

Follow-up courses:

Math 221 or Math 153 depending on student's need. Students interested in further course work in mathematics should conuslt with Professor Riner or the mathematics counselors in Math 150D.

(over)

Possible text(s):

An Introduction to Calculus with Economic Applications

Suggested course content:

I. Limits — 7 days

- Sequences
- Functions
- Continuity

II. The Derivative — 9 days

- Definition
- Techniques
- Increasing, Decreasing, and Concavity
- Applications to Curve Sketching

III. Analytic Geometry — 5 days

- Circle
- Rectangular Hyperbola
- Parabola
- Graphing Techniques

IV. Economic Applications of the Derivative — 8 days

- Total Revenue
- Marginal Revenue, Marginal Cost
- Net Revenue

V. Logarithmic and Exponential Functions — 7 days

- Definitions
- Derivatives
- "Growth" Applications -- Interest

VI. The Integral — 11 days

- Area Approximation
- Definition
- Properties and Basic Theorems
- Basic Techniques
- Applications

Course coordinator: John Riner

Spring, 1976

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Mathematics 120.01 (121) Fundamental Mathematics, Algebra

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

Recommended prerequisites:

OSU Math Placement Level 1 or 2 or a grade of C or higher in Math 101.

Catalog description:

Basic properties of real numbers, graphing, relations and functions; including exponential and logarithmic functions.

Purpose of course:

The 120 sequence consists of service courses designed to introduce students in the College of Administrative Science to single variable differential and integral calculus. Math 120.01 is the precalculus component designed to prepare students for the study of calculus.

Audience:

Generally, freshmen with majors in the College of Administrative Science. Some students in the College of Biological Sciences and the College of Agriculture also elect this course.

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. Their attitude towards the administrative science mathematics requirement is very poor. They are generally a difficult audience to motivate.

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Follow-up courses:

Math 120.02

Possible text(s): Introductory Mathematics, A Prelude to Calculus, Charles Merrill, Inc., 1975.

Suggested course content:

Unit 1 - Real numbers

*1.1 - Sets, interval notation
*1.2 - Properties of R
*1.3 - Exponents
*1.4 - Inequalities
*1.5 - Absolute value

Unit 2 - Functions and Graphs

*2.1 - Functions
*2.2 - Graphing functions
*2.3 - Polynomial functions
*2.4 - Translations
*2.5 - Graphing using mappings

Unit 3 - The Exponential and Logarithmic Functions

*3.1 - Inverse functions
*3.2 - The exponential function
*3.3 - The logarithmic function
*3.4 - Computation with logarithms
*3.5 - Applications

Each module is approximately 8 or 9 days in length.

Course coordinator: Bert Waits

Spring, 1976

* indicates topics which must be included

Mathematics 120.02 FUNDAMENTAL MATHEMATICS, **Calculus** I

A., W., S., Su. 2 cr.

Recommended prerequisites:

Math 120.01, 159.01 or 116

Catalog description:

Introductory differential calculus.

Purpose of course:

The 120 sequence consists of service courses designed to introduce students in the College of Administrative Sciences to single variable differential and integral calculus. The purpose of Math 120.02 is to introduce the student to differential calculus of algebraic functions. The course is problem oriented and little rigor is introduced.

Audience:

Generally, freshmen with majors in the College of Administrative Science. Some students in the College of Biological Sciences and the College of Agriculture also elect this course.

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 and the precalculus material in 120.01. Their attitude towards the Administrative Science mathematics requirement is very poor. They are generally a difficult audience to motivate.

Follow-up courses:

Math 122

Possible text(s):

Whipkey and Whipkey, The Power of Calculus, 2nd ed. Wiley, 1975.

Suggested course content:

Lecture #1 - 3.1-3.4, limits
Lecture #2 - 3.4-3.5, limits
Lecture #3 - 3.6-3.7, continuity
Lecture #4 - 4.1, derivatives
Lecture #5 - 4.2-4.4, formulas
Lecture #6 - 5.1-5.4, Mean Volume Theorem
Lecture #7 - 5.5-5.6, Curve Sketching
Lecture #8 - Review
MIDTERM
Lecture #9 - 5.7-5.9, applicative
Lecture #10 - 5.10, applicative
Lecture #11 - the differential and Handout on Chain Rule
Lecture #12 - Review
FINAL

Course coordinator: Bert Waits
Spring, 1976

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Mathematics 122

Fundamental Mathematics II

A., W., Sp., Su. 5 cl.

Recommended prerequisites:

Math 120.02 or 117 or 151

Catalog description:

Differential and integral calculus; series

Purpose of course:

The 120 sequence consists of service courses designed to introduce students in the College of Administrative Science to elementary differential and integral calculus. The purpose of Math 122 is to provide the business students with additional techniques of differential calculus including approximation techniques and elementary integral calculus including improper integrals. The course is problem oriented and little rigor is introduced.

Audience:

Generally, freshmen with majors in the College of Administrative Science. Some students in the College of Biological Sciences and the College of Agriculture also elect this course.

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 and the material in Math 120.01 and 120.02. Their attitude towards the administrative science mathematics requirement is very poor. They are generally a difficult audience to motivate.

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Follow-up courses:

Math 221 or Statistics 123

Possible text(s):

Whipkey and Whipkey, The Power of Calculus, 2nd ed., Wiley, 1975.

Suggested course content:

Review Ch. 4,5	2 lectures
Bisection	1 lecture
Appendix IV and V	2 lectures
Sec. 6.1, 6.2, 6.3, 6.5, 6.6, 6.7, 6.9	8 lectures
Sec. 7.1 - 7.5	3 lectures
Sec. 7.6, 7.7, 7.9	5 lectures
Chap. 8	5 lectures
3 midterms and review	4 lectures

Course coordinator: John Riner

Spring, 1976

Mathematics 148 College Algebra

A., W., Sp., Su. 4 Cr.

Recommended prerequisites:

OSU Math Placement Level 2A without trigonometry, or Level 2B; or a grade of C or higher in Math 101.

Catalog description:

Math 148 and 149 are equivalent to Math 150.

Basic properties of real numbers, graphing, functions and relations, inverse functions, exponential and logarithmic functions, and applications.

Purpose of course:

The two courses, Math 148 and 149, 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 elect this course. Some students in the College of Agriculture, Education and the College of Biological Sciences also elect 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 149

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Over

Possible text(s):

Introductory Mathematics, A Prelude to Calculus, Charles Merrill, Inc., 1975.

Suggested course content:

Unit 1 - Real Numbers

*1.1 - Sets, interval notation
*1.2 - Properties of R
*1.3 - Exponents
*1.4 - Inequalities
*1.5 - Absolute value

Unit 2 - Functions and Graphs

*2.1 - Functions
*2.2 - Graphing functions
*2.3 - Polynomial functions
*2.4 - Translations
*2.5 - Graphing using mappings

Unit 3 - The Exponential and Logarithmic Functions

*3.1 - Inverse functions
*3.2 - The exponential function
*3.3 - The logarithmic function
*3.4 - Computation with logarithms
*3.5 - Applications

Course coordinator: Bert Waits

Spring, 1976

*Indicates topics which must be included.

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Mathematics 149 Trigonometry

A., W., Sp., Su. 4 Cr.

Recommended prerequisites:

Math 120.01, 148, or permission of Department.

Catalog description:

Math 148 and 149 are equivalent to Math 150. Trigonometry and complex numbers.

Purpose of the course:

The two courses, Math 148 and 149, consist of a review of precalculus concepts and skills needed by the student entering the regular calculus sequence (151, 152, ...). The purpose of the course is to prepare the student for Math 151 (Calculus). Math 149 introduces the basic elements of trigonometry and complex numbers.

Audience:

Students with majors in the College of Engineering and the College of Mathematics and Physical Sciences generally elect this course. Some students in the College of Agriculture and the College of Biological Sciences also elect this course.

Background and attitude of audience:

Almost all 149 students will have completed 148.

Follow-up courses:

Math 151

Possible text(s):

Introductory Mathematics, by Fisher, et. al.

Suggested course content (from Introductory Mathematics):

Chapter 4 - Trigonometry I

*4.1 - The trigonometric point function
*4.2 - The sine and cosine functions
*4.3 - The tangent, secant, cosecant and cotangent functions
*4.4 - Angles, right triangles
*4.5 - The inverse sine and tangent functions
*4.6 - Identities

Chapter 5 - Trigonometry II and Complex Numbers

*5.1 - The equation $y = A \sin (ax + b)$
*5.2 - Trigonometric equations
*5.3 - The laws of sines and cosines
*5.4 - Algebra of complex numbers
*5.5 - Geometry of complex numbers
*5.6 - Roots of complex numbers

Course coordinator:

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Mathematics 150 Algebra and Trigonometry

A.,W.,Wp.,Su. 5 Cr.

Recommended prerequisites:

OSU Math Placement Level 2A and trigonometry in high school.
Or
A grade of "B" or higher in Math 101 and trigonometry in high school.

Catalog description:

Inequalities, functions, graphs, exponential, logarithmic and trigonometric functions and their graphs, complex numbers, inverse functions.

Purpose of course:

This course is a review of precalculus concepts and skills 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). The content of Math 150 is equivalent to that contained in Math 148 and 149.

Audience:

Very strong students with majors in the College of Engineering and the College of Mathematics and Physical Sciences generally elect this course. Some students in the College of Agriculture, Education and the College of Biological Sciences also elect this course.

Background and attitude of audience:

The students in this course have a wide range of interests. However their background should uniformly consist of a good knowledge of high school algebra and trigonometry. Students should be placed in Math 150 only if they have a strong background and are well motivated.

Follow-up courses: Math 151

Possible text(s):

Introductory Mathematics, A Prelude to Calculus, Charles Merrill, Inc., 1975.

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Suggested course content:

Unit 1 - Real Numbers

*1.1 - Sets, interval notation
*1.2 - Properties of R
*1.3 - Exponents
*1.4 - Inequalities
*1.5 - Absolute value

Unit 2 - Functions and Graphs

*2.1 - Functions
*2.2 - Graphing functions
*2.3 - Polynomial functions
*2.4 - Translations
*2.5 - Graphing using mappings

Unit 3 - The Exponential and Logarithmic Functions

*3.1 - Inverse functions
*3.2 - The exponential function
*3.3 - The logarithmic function
*3.4 - Computation with logarithms
*3.5 - Applications

Unit 4 - Trigonometry I

*4.1 - The trigonometric point function
*4.2 - The sine and cosine functions
*4.3 - The tangent, secant, cosecant and cotangent functions
*4.4 - Angles, right triangles
*4.5 - The inverse sine and tangent functions
*4.6 - Identities

Unit 5 - Trigonometry II and Complex Numbers

*5.1 - The equation $y = A \sin(ax + b)$
*5.2 - Trigonometric equations
*5.3 - The laws of sines and cosines
*5.4 - Algebra of complex numbers
*5.5 - Geometry of complex numbers
*5.6 - Roots of complex numbers

Course coordinator: Norman Levine

Spring, 1976

*indicates topics which must be included.

Mathematics 151, 152, 153, 254 Differential and Integral Calculus

A. W. Sp. S. 5 Cr.

Prerequisites:

Math Placement 1 or 149 or 150.

Audience:

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

Content:

151

Lines, slopes,derivatives, limits, mean-value theorem; applications of derivatives to curve sketching, maxima and minima, linear motion, related rates, and approximations; antidifferentiation.

152

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.

153

Additional techniques of integration; polar coordinates; the conis sections; three-dimenstional vectors; quadric surfaces, multiple integration, parametric equations.

254

Review of vectors and quadric surfaces; differential calculus of several variables; indeterminant forms; improper integrals; surface area; sequences and series.

Course coordinator: Frank Carroll

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Mathematics H151-H152 5 Cr. Calculus & Analytic Geometry

Mathematics H163 5 Cr. Calculus

H151 - A
H152 - W
H163 - Sp.

H151-152-163 is an integrated sequence which will substitute for Math 151, 152,153, 254 and 551.01. Sections of mathematics 151H for students entered in college honor programs and for other students who are willing to make an early commitment to an intensive study of mathematics will be made available at the beginning of each fall quarter. H151 will parallel regular 151 for the first quarter with supplementary material from vector geometry, vector calculus, and complex numbers. At the end of the first three weeks a common test will be given to all Math 151 and Math 151H students. Based on these results we hope to be able to form further sections of 151H from the interested students in 151 and also make it possible for students who now do not wish to follow the intensive track to return to the regular stream. Supplementary topics will be tested by 151H instructors by class quizzes and homework problems so that students in the honors track will be aware early of the extra demands on their time.

Uniform examinations will be given to all students in Math 151H and Math 151 through the first quarter and the student's grade will depend on these examinations only. However, supplementary class quizzes and homework problems will be required in Math 151H since our Honors series attempts to develop the student's ingenuity and resourcefulness in problem solving. Sections of Math 152H will be formed from the sections of Math 151H in the winter quarter. A student will be admitted based on his desire to continue intensive study, and the recommendation of his teacher in 151H. For the rest of the first year the Honors sequence will function independently of the regular calculus and will be under the joint coordination of the staff involved and the Honors Committee.

Topics Covered:

151H Math 151, topics in complex numbers, vector geometry, and vector calculus of one variable.

152H Logarithm, exponential, and hyperbolic functions; techniques of integration; multiple integrals - iterated integrals, polynomial approximations and Taylor series.

163H Multivariable calculus (vector approach) surface integrals, Greens theorem, Stokes theorem, divergence theorem, vector differential operators.

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Course coordinator: Henry Colson

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Mathematics 180 Insights Into Mathematics

S., A., W., Sp. 5 cr.

Prerequisite:

Sophomore Standing.

Catalog Description:

This is a liberal arts course intended to involve students with mathematics; topics covered will vary with 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 the training as an important part of their career preparation. The courses that have been used by such students in the past are skill oriented rather than liberal arts type courses. This course is one that emphasizes involvement with problems in mathematics rather than the achievement of skill. 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 the problems inherent in offering a fixed subject matter course to a large audience. To date we have involved several faculty members in 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.

Course coordinator: John Riner

Spring, 1976

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MATHEMATICS 190 Elementary Analysis

A. 5 Cr.

The main audience for this course will be honors students who advance place beyond Math 151. The material selected is designed to strengthen their mathematical background and to improve their technique with calculus through selected applications. There will be three main divisions of topics:

I. Geometry

A. Vector geometry-forumlation and proofs of results in two and three dimensions using vectors.

B. Mappings of the plane into the plane-affine maps, rigid motions, the plane identified with the complex numbers.

II. Calculus

A. Antidifferentiation applied to solving elementary differential equations.

B. Integrations from the viewpoint of numerical approximations.

III. Algorithms with emphasis on numerical techniques

A. Zeros of functions.

B. Sequences defined by iteration.

C. Fixed points of mappings.

Course coordinator: Henry Colson

Spring, 1976

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Mathematics 221 Fundamental Mathematics III

A., Sp. 5 cr.

Catalog description:

A continuation of Math 122; several variable calculus with business applications.

Purpose of course:

(a) To prepare the student for Statistics 425
(b) To prepare the student for additional work in mathematics

Audience:

CIS majors in the College of Administrative Science

Students are generally weak mathematically and not well motivated. They have usually had 14 weeks of single variable calculus. This needs to be reviewed, with particular emphasis placed on calculus of exponential and logarithmic functions, the fundamental theorem, and integration techniques.

Follow-up courses:

Math 471, Statistics 425

Possible text(s):

See the course coordinator

Suggested course content:

*Review of single variable calculus, including calculus of exponential and logarithmic functions, integration techniques, approximations, fundamental theorem

*Partial derivatives

*Optimization including LaGrange Multipliers

*Double Integrals in rectangular coordinates

*Improper Integrals

Taylor's Series

Course coordinator: Bert K. Waits

Spring, 1976

*indicates topics which must be included.

Mathematics 255

Differential Equations
and Their Applications

A., W., Sp., Su. U G 5

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.

Follow-up course:

Math. 557
I would like the instructors in Math 255 to encourage those students who show interest in differential equation to take 557.

Possible text(s):

Boyce and Diprime: Elementary Differential Equations
John Wiley and Sons.

Suggested Content:

Chap. 1 :	1/2 weeks
Chap. 2 :	2-2 1/2 weeks
Chap. 3 :	2-2 1/2 weeks
Chap. 4 :	(§4.1-§4.5): 1 1/2 - 2 weeks
Chap. 6 :	1 1/2-2 weeks
Chap. 8 :	1/2-1 1/2 weeks

Course coordinator: Y.C. Lu

Spring, 1976

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Mathematics 256 Differential Equations with Applications

S., A., W., Sp. 4 cl.

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 text(s):

A Short Course in Differential Equations, Rainville and Bedient

Content:

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

(over)

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Suggested Outline: (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 Application	2 days
Review before tests	9 days
Tests	3 days
	40 days

Course coordinator: Dan Eustice

Spring, 1976

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H290-291-292 A,W,Sp 5 Cr. Linear Algebra & Multi-Vairable Calculus

(Substitutes for Math 568, 569; Math 556 (255,256,415) and Math 547, 548 and 552.)

Topics Covered:

H290: Vector spaces, linear maps, matrices, systems of equations, determinants 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. Introduction of topics in real analysis as needed.

H292: Convergence properties of sequences of real and complex numbers, sequences of functions, complex variable theory, including Cauchy Integral Theorem, elementary functions and mappings, residue theory.

Course coordinator: Henry Colson

Spring, 1976

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Mathematics 345 Foundations of Higher Mathematics

A., Sp. 4 Cr.

Recommended prerequisites:

153 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 (153) 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 mathematical proof.

Audience:

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

Text:

The course is presently being taught from notes which are supplied to the students by the lecturer.

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

Course coordinator: Joseph Landin

Spring, 1976

Mathematics 415 — Ordinary and Partial Differential Equations

A., W., Sp. 5 cl.

Recommended prerequisites:

Math. 254

Catalog description:

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

Purpose of course:

One hopes to introduce 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 and aeronautical engineering students to problem solving in differential equations.

Possible text(s):

Boyce and De Prime, Differential Equations

Suggested course content:

Using Boyce and De Prime:

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 - 11.8	13
11.1 - 11.6	5
Optional Material	3 - 5 Systems

Course coordinator: Dan Eustice

Spring, 1976

Mathematics 416 Vector Analysis and Complex Variables

A., Sp. 5 cl.

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 vector analysis portion is needed for engineering courses which many students take concurrently and for this reason should be covered first. The course is a prerequisite for Electrical Engineering and Aeronautical Engineering. Minimal proofs should be the rule (e.g., Cauchy Theorem by Green's Theorem rather than Cauchy-Goursat) or intuitive explanations.

Audience:

This is primarily an application or problem solving course for undergraduate engineering students.

Possible text(s):

Vector analysis, Schaum's Outline

Complex variables, Churchill

(over)

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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 variable -- 35 classes including test

1. COMMENT -- Use first 3 weeks of quarter. 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 -- included independence of path

   Chap. 6 -- 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: Dan Eustice

Spring, 1976

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Mathematics 471 Matrices and Linear Algebra

A., W. 5 cr.

Recommended prerequisites:

Math 221 or equivalent or permission of instructor

Catalog description:

Not open to students with credit for H290, 505, 568, or 576. Intended for CIS majors in the College of Administrative Science. Matrices, systems of equations, R^n, determinants; 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, 569, or 576. Further, emphasis is placed on the topics as tools rather than as development of structure; applications may be chosen from Markov processes, linear programming, and others.

Audience:

The course is required for CIS majors in the College of Administrative Science.

Students are generally weak mathematically and not well motivated. They have a strong desire to see applications of this material. They also have a strong dislike for formalism and only barely follow the simplest proofs.

Possible text(s):

Elementary Matrix Algebra with Linear Programming by Painter and Yantis

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;
Eigenvalues and Eigenvectors;
Quadratic forms;
Linear transformations;
*applications - Markov chains, linear programming.

Course coordinator: Jerry Silver

Spring 1976

*indicates topics which must be included

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Mathematics 501, 502, 503 Fundamentals of Mathematics I

501 - A.	4 Cr.
502 - A., W., Sp.	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:

Spring, 1976

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Mathematics 504 The History of Mathematics

A., Sp. 5 cl.

Recommended prerequisites:

Math 580 or 571 or 568 or 507 or permission of instructor

Catalog description:

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

Purpose of course:

This course is an introduction to the History of Mathematics. The 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 background and motivation of the average student in this course is poor.

Follow-up courses:

This course is terminal.

Possible text(s):

Eves: An Introduction to the History of Mathematics (3rd ed.)

Suggested course content:

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

1) * reading: (1) Eves or 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
Spring, 1976

Mathematics 507 Advanced Geometry

A., W. 5 cl.

Recommended prerequisites:

Math 152 (Integral Calculus)

Catalog description:

Advanced topics from Euclidean Geometry.

Purpose of course:

The course introduces advanced topics as extensions of elementary Euclidean geometry. The material should be useful both to mathematicians and to teachers.

Audience:

The course is required for Education College students specializing in the teaching of secondary school mathematics. About one-fourth of the students are enrolled in Arts and Sciences.

The majority of students have weak backgrounds in the content of high school geometry and analytic geometry. The general attitude of students is highly favorable.

Follow-up courses:

No follow-up course is required. Math 608 is designed especially for students who wish to continue the study of geometry on a more advanced level.

Possible text(s):

Miller, An Introduction to Geometry

Modenov and Parkhomenko, Geometric Transformations

Suggested Course Content:

*Review of high school geometry with generalizations

*Euclidean and affine transformations

Circular Inversion

Projective Transformations

Finite Geometries

Course Coordinator: Leslie Miller

Spring, 1976

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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.
2. Wiley, Advanced Engineering Mathematics, McGraw Hill.

   Both of these contain all the material needed, and much more. They are good reference books for engineers to own, especially if they intend to take further mathematics courses.

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.

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.
   Wiley - Chapter 6, Sections 6.1 to 6.5.
   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.

   Kreszig - Chapter 10, Sections 10.1, 10.3, 10.4, 10.5. Skimpy on Laplace's equation.
   Wiley - Chapter 8, Sections 8.3, 8.4, 8.6. Wiley is a bit skimpy here.
   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.
   Wiley - Chapter 7, Sections 7.1 to 7.6, omitting 7.5.
   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

Spring, 1976

Mathematics 513 Vector Analysis for Engineers

W. 3 cl.

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.

Suggested course content:

Fron 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

Spring, 1976

Mathematics 514 Complex Variables for Engineers

Sp. 3 cl.

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
2. Smith, Elementary Complex Variables, Merrill
3. Wiley, Advanced Engineering Math
4. Kreyzig, Advanced Engineering Math

The last two contain much diverse material. They are excellent references 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.

(Over)

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Suggested course content:

Syllabus based on Churchill:

1.	Complex Numbers, polar form	3 days
2.	Analyticity, Cauchy-Riemann	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

Course coordinator: J. T. Scheick

Spring, 1976

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Mathematics 530 Probability I

A., 5 cl.

Recommended prerequisites:

M. 254

Catalog description:

Combinatorial probability, examples of distributions, expectation, variance, generating functions, 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 strenthened 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(s):

E. Parzen, Modern Probability Theory, K. L. Chung, Elementary Probability Theory with Stochastic Processes

Suggested course content:

The catalog description is accurate.

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Course coordinator: Louis Sucheston

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Mathematics 531 Probability II

W., 5 cl.

Recommended prerequisites:

Math 530

Catalog description:

Continuation of 530; Markov chains, stochastic processes.

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.

Suggested course content:

The catalog description is accurate.

Course coordinator: Louis Sucheston

Spring, 1976

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Mathematics 545 Mathematical Logic I

W. 5 cl.

Recommended prerequisites:

153 or permission of instructor.

Catalog description:

Introduction to formal logical systems with applications to mathematical foundations. Topics include: mathematical proof; statement calculus; predicate calculus; first order number theory; consistency; completeness.

Purpose of course:

This course should introduce the student to working in formal systems, with particular attention paid to one formulation of predicate calculus.

Audience:

About half are mathematics majors. The remainder come principally from computer science, philosophy, and mathematics education.

Background and attitude of audience:

The mathematical preparation of the students is quite varied; some have only minimal prerequisite (which was put in order to keep out students having no college mathematics, since "infinitesimal" calculus per se is of no direct use here), whereas others have extensive mathematical backgrounds. About half of the students have had some training in logic (mainly in the philosophy department); this is sometimes helpful and sometimes hindranceful.

Follow-up courses:

M 546.

Possible text(s):

Margaris, First Order Mathematical Logic, sections 1-25

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Course coordinator: Leroy F. Meyers

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Mathematics 546 Mathematical Logic II

Sp. 5 cl.

Recommended prerequisites:

M 545 (requires a grade of at least B .)

Catalog description:

Advanced topics in first order theories: Such as Goedel's completeness and incompleteness theorems; model theory; recursive function theory; abstract machines; set theory.

Audience:

The class has been very small, generally from mathematics and philosophy.

Background and attitude of audience:

Fair to good mathematically. Generally enthusiastic.

Follow-up courses:

None at the undergraduate level.

Possible text(s):

Boolos and Jeffrey, Computability and logic.

Suggested course content:

The content is variable. Usually more advanced topics in first order theories.

Course coordinator: Leroy F. Meyers

Spring, 1976

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Mathematics 547 Introductory Analysis I

Su, A. W. 3 cl.

Recommended prerequisites:

254 or permission of instructor
Not open to students with credit for 550

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 content of 547 and 548 is that of Math 550. 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.

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Course coordinator: David Dean

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Mathematics 548 Introductory Analysis II

Su., W., Sp. 3 cl.

Recommended prerequisites:

547 or permission of instructor
Not open to students with credit for 550

Catalog description:

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

Audience:

The content of 547 and 548 is that of Math 550. The students will be principally mathematical and physical science majors and engineers.

Follow-up courses:

549 or 551.02 or 552.02

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.

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Course coordinator: David Dean

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Mathematics 549 Introductory Analysis III

Sp. 3 cl.

Recommended prerequisites:

548 or 550 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:

551.02 or 552.02

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

Spring, 1976

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Mathematics 551.01 Vector Analysis

Au., Sp. 5 cl.

Recommended prerequisites:

Math 254

Purpose of course:

This course was designed primarily for physics majors and is not recommended for math majors. 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.

Possible texts:

Kaplan - Advanced Calculus, with supporting problems from Schaum.

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.

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Course coordinator: Henry Colson
Spring, 1976

Mathematics 551.02 Advanced Calculus II

A. 5 cl.

Recommended prerequisites:

Math 547 and 548

Purpose of course:

The course continues as a follow-up to Math 547 and 548. Students are introduced to functions of more than one variable, integration, and transformation of variable theorems.

Audience:

Primarily math majors

Possible text(s):

Avner Friedman
Watson Fulks

Suggested course content:

Continuity and differentiability for functions of more than one variable. Jacobians and their uses, Definite integration 1, 2, and 3 dimensional with ideas presented mostly from 1 and 2 dimensions, Line and surface integrals, Topics from vector analysis as needed for the integral theorems of Stokes, Green, etc., Taylor expansions of functions of more than one variable.

Course coordinator: Henry Colson

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Mathematics 552.01 Complex Variables I

Su., W. 5 cl.

Recommended prerequisites:

M. 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:

Required in the Physics program (they take 551.01 and 552.01, but not 550). Acceptable in a math major program. Occasional engineering grad student.

Background and attitude of audience are good.

Follow-up courses:

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

Possible text(s):

Churchill, Kaplan, a dozen others.

Suggested course content:

Algebra of complex numbers, geometry of the complex plane, elementary functions and mappings, Taylor's and Laurents series*, residue Calculus*.

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Course coordinator: F. W. Carroll

Spring, 1976

Mathematics 552.02 Complex Variables I

W. 5 cl.

Recommended prerequisites:

Math. 550

Catalog description:

The Cauchy integral theorem and its consequences, elementary functions and mappings, representation theorems, residue theory.

Purpose of course:

This is a first course in complex variables for those with a stronger analysis background than elementary calculus provides. Problem technique is not to be slighted, but more than this is expected. Statements and proofs of a few major theorems, use of lim sup, and uniform processes, for instance, may occur without apology. The complex variables content of 552.01 should be covered in such a way as to contribute to the analytic maturation of the students.

Audience:

Mathematics majors, for the most part.

Background and attitude of audience are good.

Follow-up courses:

Same as Math. 552.01.

Possible text(s):

Hille I, Levinson and Redheffer, a dozen others.

Suggested course content:

Same as catalog description.

REMARK: Due to small audiences, the classes for 552.01 and 552.02 are sometimes combined. When this happens, the prudent instructor will teach .01 rather than .02.

Course coordinator: F. W. Carroll

Spring, 1976

Note: The department expects to offer an honors section of 552 at least every other year. Strong students are urged to check with their advisers about this course.

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Mathematics 556 Differential Equations

A., Sp. 5 cr.

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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 (boundary value problems need not be covered because they are dealt with in Math 557). 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 of 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 physolophy in this course is to build a bridge in between the calculus sequence and more advance analysis courses. For instance, uniform convergence naturally be introduced in finding solutions by approximation.

Possible text: Bauer and Nobel, Ordinary Differential Equations, 2nd ed.

Suggested content:

1. First order linear equations
2. Second order linear equations
3. Series solutions of linear equations
4. Existence theory and numerical methods of solutions.

Course Coordinator: Y. C. Lu

Spring, 1976

Note: The department expects to offer an honors section of 556 at least every other year. Strong students are urged to check with their advisers about this course.

Mathematics 557

Orthogonal Systems and Differential Equations.

W. 3 Cr.

Recommended Prerequisites:

Either Math 255 or Math 556.

Purpose of course:

Fourier Series and Integrals are essential ingredients in this course. The solution of boundary value problems is the main purpose of this course. Separation of variables is the main method employed because of its frequent appearance and because it provides a uniform technique for solving important cases of the heat, wave, and potential equations. This course is designed for students in engineering, physics and mathematics.

Possible text(s):

Powers: Boundary Value Problems, Academic Press.

Suggested content:

Chap.	1	2 - 2 1/2 weeks
Chap.	2	2 1/2 weeks
Chap.	3,4	3 1/3 weeks
Chap.	6	1 1/2 weeks

Course Coordinator: Y. C. Lu

Spring, 1976

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Mathematics 560 Topology

Sp. 5 cr.

Prerequisites:

Math 550

Catalog description:

Sets and functions, metric spaces, completeness, Baires theorem, continuous mappings, Euclidean spaces, compactness, connectedness, topological spaces.

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

Spring, 1976

Note: The department expects to offer an honors section of 560 at least every other year. Strong students are urged to check with their advisers about this course.

Mathematics 568 Linear Algebra I

Su., A., W., Sp. 3 cl.

Recommended prerequisites:

153 or permission of instructor
Not open to students with credit for 471, 576, 571

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:

The sequence 568 and 569 is equivalent to 571 with emphasis placed on techniques and computational skills. The students would be predominantly 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, CIS, engineering, and mathematical sciences.

Follow-up courses:

For Math majors: the sequence 580, 581, 582
For service: 569

Possible text(s):

Elementary Linear Algebra, Shields, Worth

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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; 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: J. R. C. Leitzel

Spring, 1976

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Mathematics 569 Linear Algebra II

Su., W., Sp. 3 cl.

Recommended prerequisites:

568 or permission of instructor
Not open to students with credit for 471, 576, or 571

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. The two course sequence 568 and 569 substitutes for 571.

Follow-up courses:

Any course having a linear algebra prerequisite.

Possible text(s):

Elementary Linear Algebra, Shields; Worth

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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: J. R. C. Leitzel

Spring, 1976

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Mathematics 571 Introduction to Linear Algebra

Sp. 5 cl.

Recommended prerequisites:

153 or permission of instructor
Not open to students with credit for H290, 471, 568, 569

Catalog description:

Not open to students with credit for H290, 471, 568, or 569. Vector spaces, linear maps, matrices, inner product spaces, systems of equations, determinants, and spectral theory.

Audience:

The course is a "technique" course in linear algebra. It is utilized by students in the physical sciences, CIS, and engineering as well as those in the mathematical sciences major. Mathematics majors should be rare in this course as they should be taking the 568 in preparation for the 580-581-582 sequence. The group would be predominantly sophomores who plan to enroll in 556.02, the differential equations course based on linear algebra and upper division students from engineering. The prerequisite is mainly for sophistication, not content.

Follow-up courses:

556.02, possibly 577, 574, 575.

Possible text(s):

Currently the course text is Elementary Linear Algebra, Shields, 2nd Edition, Worth

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Suggested course content:

The emphasis of the course typically is on linear transformations and their efficient description via matrices. Inner product spaces and quadratic forms should be treated and the geometric and physical interpretations pointed out. Because of the background of the audience all vector spaces will normally be spaces over the real and/or complex numbers. For most students this is the first encounter with an abstract mathematical system.

1. Systems of equations, matrices, rank, determinants.
2. Vector spaces -- basis and dimension.
3. Linear transformations, inverses.
4. Characteristic polynomials, eigenvalues.
5. Inner product spaces, quadratic forms
6. Spectral theory (Principal axis theorem).

Course coordinator: J. R. C. Leitzel

Spring, 1976

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Mathematics 573 Elementary Number Theory

W 5 cl.

Recommended prerequisites:

Sophomore standing

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; to develop reasonable facility in the student of proof foundation.

Audience:

Audience is varied; for many a first course in presenting mathematical proof.

Possible text(s):

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.

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Course coordinator: J. R. C. Leitzel

Spring, 1976

Mathematics 574 Geometry

A. 5 cr.

Prerequisites:

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

Catalog description:

Euclidean and non-Euclidean geometry, emphasizing algebraic connections; affine and projective planes, duality. Topics from: geometry of groups, finite planes, HILBERT's postulates, n-dimensional geometry.

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. Not enough students signed up for the course this spring quarter (1975).

Texts:

I tried to use SNAPPER & TROYER, Metric affine geometry, and PEDOE, A course of geometry for colleges and universities. Both texts have much too much material for a 10-week course. Next time I try FISHBACK, Projective and Euclidean geometry.

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
Spring, 1976

Mathematics 575

Combinatorial Mathematics and Graph Theory

W., Sp. 5 Cr.

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 designs and coding theory.

Purpose of course:

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

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

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.

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Possible text(s):

There has been some difficulty in selecting a suitable text. The following books have been used in the past, and at least give some indication of the subject matter.

1. C. L. Liu, "Introduction to Combinatorial Mathematics."

2. F. Harary, "Graph Theory."

3. H. Ryser, "Combinatorial Mathematics."

Suggested course content:

1. Permutations; the fifteen puzzle.

*2. Matching theory: the "Marriage Theorem" and a few applications.

3. Ramsey's Theorem for graphs.

*4. Elementary topology of graphs: paths, connectivity, cycles, cutsets, trees, bipartite graphs, Eulerian and Hamiltonian paths and circuits.

*5. Flows in networks; Menger's Theorem.

6. Linear programming.

7. Convexity; combinatorial geometry.

8. Planar graphs; map coloring.

*9. Combinatorial designs: Latin squares, magic squares, finite geometries, difference sets, Steiner triple systems; error-correcting codes.

*10. Enumeration theory: Inclusion - exclusion principle, possibly elementary Polya theory of counting.

Basic principles (sets, mappings, one-to-one correspondences and cardinality, incidence relations and combinatorial structures, the pigeonhole principle, the rules of sum and product and other elementary counting techniques, mathematical induction, etc.) are repeatedly emphasized.

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Course coordinator: R. M. Wilson

Spring, 1976

Mathematics 576

Linear Algebra and Discrete Algebraic Structures

A., W., 5 cr.

Catalog description:

Linear algebra (vector spaces, linear maps, matrices, systems of equations) and an introduction 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 purpose of this course and its sequel Math 577.01 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.

Important Remark:

CIS students who wish to take both a linear algebra and a structure course have two options:

I. Math 571 or equivalent, and then Math 577.02 in the Autumn.

II. Math 576 in Winter, and Math 577.01 in Spring.

It is greatly preferable for students to take this second option; indeed, the courses in II (which are taught as a sequence) were introduced because of difficulties experienced in relating the courses in I. Students who desire only a course in linear algebra should probably take 571 rather than 576.

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.

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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.

Follow-up courses:

It is expected that students will continue with Math 577.01.

Possible text(s):

The present texts for the sequence 576-577.01 are

1. Schaum's Outline "Linear Algebra.
2. N. H. McCoy, "Fundamentals of Abstract Algebra."

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

Suggested course content:

I. Introduction to algebraic structures and elementary number theory.

Remarks on logic. Sets and binary operations. The integers, g.c.d.'s and the Euclidean algorithm. Congruences and the rings of residue classes modulo n.

II. Fields.

The fields Z_p and GF(4). The rationals.

III. Linear algebra (over arbitrary fields).

Linear independence, bases, dimension. Standard inner product. Matrices, row operations, and systems of equations. Group codes over Z_p (illustrating matrices as transformations).

While not explecitly mentioned above, it is desirable to illustrate and emphasize principles of finite mathematics (the pigeonhole principle, counting techniques, etc.).

Depending on the wishes of the CIS faculty, the course in the future may contain more material on graphs or Boolean algebra.

Course coordinator: R. M. Wilson
Spring, 1976

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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Possible text(s):

The present texts for the sequence 576-577.01 are

1. Schaum's Outline "Linear Algebra."

2. N. H. McCoy, "Fundamentals of Abstract 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. Rinite fields and polynomial codes.

Course coordinator: R. M. Wilson

Spring, 1976

Mathematics 577.02 Discrete Algebraic Structures

Sp. 5 Cr.

Recommended prerequisites:

Math 571 or equivalent.

Catalog description:

An introduction to discrete and finite algebraic structures with applications to computer and information science.

Purpose of course:

This course is intended primarily for CIS majors and provides a foundation in discrete and finite algebraic structures. 577.02 is offered as an alternative to the sequence 576-577.01 for those students who have already seen some linear algebra, perhaps at another university.

Audience:

The students are upper level undergraduates with the exception of a few beginning graduate students.

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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Possible text(s):

The present text is N. H. McCoy's "Fundamentals of Abstract Algebra", augmented by notes on primitive elements, polynomial congruences, and error-correcting codes.

Suggested course content:

I. Elementary number theory and an introduction to structure.

Remarks on logic. Sets and binary operations. The integers, g.c.d.'s and the Euclidean algorithm. Congruences and the rings of residue classes modulo n.

II. Groups.

Groups of permutations, Cayley graphs. Lagrange's Theorem. Units in Z_n, and primitive roots modulo p. Group codes over Z_p.

III. Polynomial rings.

Euclidean algorithm and factorization. Congruences and factor rings. Finite fields and polynomial codes.

Depending on the wishes of the CIS faculty, the course may in the future contain more material on graphs or Boolean algebra.

Course coordinator: R. M. Wilson

Spring, 1976

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Mathematics 580, 581, 582 — Three Quarter Algebra Sequence

580: A
581: W
582: Sp

580: 3 credits
581: 3 credits
582: 3 credits

Recommended prerequisites:

Math 568 or Math 571 (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. Each year 4 or 5 students from each section seem to develop particularly well and we have been adding 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(s):

McCoy, Goldstein, Dean, Paley and Weichsel, Fraleigh

Suggested course content:

This course need not follow a syllabus. An instructor can respond to the particular needs of the students as he sees them. 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 problems.

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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.

Group theory: direct sums, Cauchy's Theorem, p-groups, Sylow Theorems; structure of finite abelian groups.

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
Spring, 1976

Mathematics 100 5 cl. Introduction to College Mathematics

Su., A., W., Sp.

Not to count toward graduation credit.

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 100 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 101B01.

Purpose for having both 100A and 100B:

The content of both 100A and 100B is identical. The only difference is the format for instruction. 100A is done in a lecture-recitation situation. 100B is taught in small sections. The students with ACT composites of 10 or less are the audience for 100B.

Audience:

Students are placed in Math 100 only if scores on both the mathematics portion of the ACT and on the OSU Mathematics Placement Test show serious mathematical difficulties and also serious difficulties in general scholastic aptitude. The typical student has had less than two years of high school mathematics. We assume that all students who take Math 100 will need at least a next mathematics course for their chosen major. A 100 student should normally go into 101B01 as a follow-up course. Students who place Level 5 but do not need mathematical skills in their major programs can take Math 180.

Follow-up Courses:

Math 101B01

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Topics:

1. Real Numbers

   The Number Line
   Arithmetic of Fractions
   Arithmetic of Decimals
   Arithmetic of Real Numbers

2. Basic Algebra

   Simplification of Algebraic Expressions
   Solving Linear Equations
   Applications of Linear Equations

3. Graphing Equations

   The Cartesian Coordinate System
   Plotting Points
   Graphing Equations
   The Straight Line
   Solving Systems of Linear Equations
   Applications

4. Geometry

   Plane Figures
   Measurement
   Square Roots
   Pythagorean Theorem
   Development and Use of Formulas
   Distance in the Plane

Course coordinator: John Riner
Spring, 1976

Mathematics H590, H591, H592 Algebraic Structures I, II, III

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

Recommended Prerequisites:

H590: 290 or permission of instructor
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 text(s):

Topics in Algebra, Herstein, Xerox

Basic Algebra, Jacobson, Freeman

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.

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; normal, separable, automorphisms of fields.

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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