Department of Mathematics
The Ohio State University

1975-1976 Mathematics Courses

Course Number	Course Title
101.01	Basic College Mathematics I
101.02	Basic College Mathematics II
105	Mathematics for Elementary Teachers
106	Mathematics for Elementary Teachers
107	Mathematics for Elementary Teachers
116	Survey of College Algebra
117	Survey of Calculus
120.01	Mathematics for the Business, Social, and Biological Sciences-Algebra
120.02	Mathematics for the Business, Social, and Biological Sciences-Calculus I
122	Mathematics for the Business, Social, and Biological Sciences II
151	Differential and Integral Calculus
152	Differential and Integral Calculus
153	Differential and Integral Calculus
254	Differential and Integral Calculus
151H	Differential and Integral Calculus
152H	Differential and Integral Calculus
153H	Differential and Integral Calculus
190H	Differential and Integral Calculus
159.01	Calculus and Analytic Geometry-Algebra
159.02	Trigonometry
180	Insights into Mathematics
221	Elements of Calculus III
255	Differential Equations and Their Applications
256	Differential Equations with Applications
290H	Second Year Honor Sequence
291H	Second Year Honor Sequence
292H	Second Year Honor Sequence
345	Foundations of Higher Mathematics
415	Ordinary and Partial Differential Equations
416	Vector Analysis and Complex Variables
471	Matrices and Linear Algebra
501	Fundamentals of Mathematics
504	The History of Mathematics

Course Number	Course Title
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
550	Advanced Calculus I
551.01	Vector Analysis
551.02	Advanced Calculus II
552.01	Complex Variables I
552.02	Complex Variables I
553	Complex Variables II
556	Differential Equations
557	Orthogonal Systems and Differential Equations
560	Topology
568	Linear Algebra I
569	Linear Algebra II
570	Elementary Modern Algebra
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

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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

Spring, 1975

Mathematics 105 — Mathematics for Elementary Teachers

W., Sp., Su. 5 cl.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Recommended prerequisites:

Level III placement or Math 101

Purpose of course:

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

Audience:

Elementary education majors, mainly at the sophomore level. (This course, together with 106, satisfies the mathematics requirements of the certification program for teachers in the State of Ohio) Students have very wide range of abilities, background, and interests.

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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 106

Mathematics for Elementary Teachers

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, 1975

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Mathematics 107 — Mathematics for Elementary Teachers

W., Sp.

Recommended prerequisites:

Mathematics 106

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, 1975

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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:

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.

(over)

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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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:

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 consult with either Professor Riner or Professor Elbrink.

(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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 120.01 (121)

Mathematics for the Business, Social, and Biological Sciences - 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, functions, and relations.

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.

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, 1975

*indicates topics which must be included

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 120.02

Mathematics for the Business, Social, and Biological Sciences - 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.

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Follow-up courses:

Math 122

Possible text(s):

Calculus with Applications to the Social and Life Sciences, by W. S. Hart, 1973 edition.

Suggested course content:

Introduction to Limits and the derivative

Topic	Text Reference (Section)
Limits	Hart: 4, 24
Review	
Continuity	Hart: 5
The Derivative	Hart: 2, 3
Sum, Product, Quotient Rules	Hart: 6, 8, 9
Chain Rule	Hart: 12

Applications of Differential Calculus for Business Students

Topic	Text Reference (Section)
Higher Order Derivatives and Implicit Differentiation	Hart: 14, 15
Graphing I, Increasing and Decreasing Properties	Hart: 20
Graphing II, Concavity	Hart: 21, 22
Max-Min Problems	Hart: 23
Review	
Economic Applications	Hart: 10 and 11 Problems 10, 11, 12 and 12 on page 130

Each unit is approximately 10 or 11 days in length.

Course coordinator: Bert Waits

Spring, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 122

Mathematics for the Business, Social, and Biological Sciences 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.

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Mathematics 122
Follow-up courses:

Math 221 or Statistics 123

Possible text(s):

Calculus with Applications to the Social and Life Sciences, by W. S. Hart, 1973 edition.

Suggested course content:

MATH 122

(Math 120.03 - 2 Credit Hours)

Topics (Text Reference)	Suggested Length[1]
*Review: Applications of the first and second derivatives, second derivative test, curve sketching, maximum-minimum problems, concavity, etc. (Sections 20-23, 25)	4 days
*Derivatives of transcendental functions (Sections 28-33) . .	3 days
*L'Hopital's Rule (Section 88)	1 day
*Sequence and series (Sections 36-38 and 113-114)	2 days
*Approximation Techniques . . . . . Linear approximation by differentials (Section 18), Newton's Method (Section 39), Taylor's Formula (Section 123)	3 days
*Business and economic applications (Selected topics from Sections 10, 11, 26, 27, 35).	2 days
Tests and review	4 days

(Math 120.04 - 3 Credit Hours)

*Area approximations (Sections 43 and 112)	2 days
*The definite integral (Sections 42 and 44)	3 days
*The indefinite integral or antiderivative (Sections 41 and 45)	2 days
*Area applications (Section 47)	2 days
*Techniques of integration - parts (Section 49)	2 days
*Techniques of integration - substitution (Section 73). . . .	2 days
Techniques of differentiation and integration involving trigonometric functions (portions may be omitted if time is short) (Sections 104-106, 108).	3 days
*Improper integrals (Sections 89 and 90).	3 days
*Business and economic applications (Selected topics from Sections 50, 51, 77, 78, 79, 80, 81, 85, 86, 91, 92).	4 days
Tests and review	6 days

[1] Based on a 48-day quarter

Course coordinator: Bert Waits

Spring, 1975

*indicates topics which must be included

NOTE: The exact content of this course and the order of presentation of the topics may vary somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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

Prerequisites:

Math Placement 1 or 159.02

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 areas, 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 conic sections; indeterminate forms; improper integrals; Taylor's formula; infinite series.

254

Vectors in the plane and parametric equations; vectors in three-dimensional space and solid analytic geometry; differential calculus of functions of several variables; multiple integration.

Course coordinator: Frank Carroll

Spring, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics H 151
and
Mathematics H 190

Arnold E. Ross

We have felt that every student with a keen interest in his chosen profession and possessing a better than average experience with mathematics in the high school could benefit by a basic freshman mathematics course which would reflect the needs of his chosen occupation, in case this prospective occupation makes significant use of mathematical ideas.

Our courses H 151, H 152, H 153 have been designed to reflect the increasing and ever earlier demand for mathematical techniques the study of which has been usually deferred to later courses. Our Honors series also attempts to develop the student's ingenuity and his resourcefulness in problem solving.

We do plan to give much attention to the astute use of the computer and to the numerical analysis methods in the calculus. These are of ever growing importance to the engineer, to the scientist, to any person making use of quantitative methods in economics, social sciences or business and to the pure mathematician as well.

Vector methods in analytic geometry and the calculus lay an important foundation for later mathematics studies and for many applications as well. We study such vector methods at the very outset of our program.

It is quite natural to study the complex calculus alongside the real variable calculus. Student's experience with vector methods is of help when he begins the study of complex numbers. Among other things these last, introduced geometrically, help the student to grasp very quickly the trigonometric addition formulae and similar useful trigonometric relationships. The definite integral is introduced almost simultaneously

with the introduction of the derivative. Infinite series in particular Taylor series are introduced early.

An effective use of numerical methods and the utilization of the computer call for a reasonably deep understanding of a variety of limit processes. Because of this, some change of the order in which the basic ideas of the calculus are developed, is called for. However, surprisingly enough, the development of the elementary calculus manipulative skills within each quarter does not differ essentially from the usual practice.

A student may like mathematics and he may have had happy experience with mathematics and still he may hesitate to commit himself at once to a very intensive program of mathematics study. We have arranged our work so as to make it possible for every student interested in mathematics to participate in our program long enough to be able to make a happy (happy for him!) decision about his mathematics studies. The honors program has been organized so that during the first four weeks a student who should wish to shift to the ordinary track may do so without suffering any hardship.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 159.01 (150) Calculus and Analytic Geometry - Algebra

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

Recommended prerequisites:

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

Catalog description:

Basic properties of real numbers, graphing, functions, and relations.

Purpose of course:

The two courses, Math 159.01 and 159.02, consist of a review 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.

Follow-up courses:

Math 159.02

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 nine (8 or 9) days in length.

Course coordinator: Bert Waits

Spring, 1975

* indicates topics which must be included.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 159.02 Trigonometry

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

Recommended prerequisites:

Math 120.01, 159.01 or permission of course supervisor.

Catalog description:

Trigonometric and inverse trigonometric functions and applications, including complex numbers.

Purpose of course:

The two courses, Math 159.01 and 159.02, 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 159.02 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:

The students in 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 159.01.

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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

Each chapter is approximately 11 days in length.

Course coordinator: Jerry Silver

Spring, 1975

*indicates topics which must be included

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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

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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

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: Jerry Silver

Spring, 1975

*indicates topics which

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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 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, 1975

Math 256

Winter, 1975 — F. W. Carroll

Tentative Schedule — MA 212, Phone 422-5257

Text: A Short Course in Diff. Equations, Rainville and Bedient

The course will meet M T W R. It will be divided into three parts, each ending with a test. Homework will not be collected, but most days a short 10-minute homework quiz will be given at the beginning of the period. Days when there is no quiz are marked with a star (*) in the list below.

Part I - Technique, applications and theory of first order equations.

Date	Section	Homework
Monday, Jan. 6	Chapter 1	p. 5, p. 9, p. 14
7	Sec. 5, 7	p. 16, any 3; p. 24, any 10
8	Sec. 13	p. 49; 1, 2, 16-22
9	Sec. 14	p. 50; 3-7
13	Sec. 15	p. 50; 8-15
14	Sec. 10	p. 35; 3, 6, 9,...
15	Sec. 11	p. 40; 3, 6, 9,...
16	Sec. 12	(same)
20	Sec. 8, 9	p. 29, 3, 6, 9,...
21	Review, your questions	
22*	Review of applications	
23*	Test I	

Part II - Technique, applications, and theory of linear equations with constant coefficients.

Monday, Jan. 27*	Sec. 33-35	(p. 101 and 104),5,10,15,20,23,25,27,29
28	Sec. 36,37	p. 108, 5,10,15,20; misc.,5,10,...,45
29	Sec. 39-41	(p. 120 and 126), 5,10,...,45,(50)
30	Sec. 67,68	p. 212, 1,5,8,12,13,22,23
Feb. 3	Sec. 69	p. 216; 1, 3, 5,...,25
4	Sec. 70	p. 223; 1, 3, 5, 7, 9, 11
5	Review of applications	
6	Sec. 25-27	p. 86, 1-7
10	Sec. 44, 45	p. 137; 5, 10, 15, 19
11	Sec. 28, 29	None
12*	Review	
13*	Test II	

Part III - Technique, applications, and theory of systems of equations.

Date	Section	Homework
Tuesday, Feb. 18*	Sec. 72, 81	p. 228; 3, 6,...,15; p. 275, 3-10.
19	Sec. 74, 75	p. 238; 1-8, 16-25
20	Sec. 82	p. 277, 13-14
24	Sec. 76	p. 246; 1, 3, 5, 7
25	Sec. 76	p. 246; 2, 4, 6, 8
26	Sec. 77	p. 250; 1, 3, 5, 7, 9, 11
27	Supplementary applications	
Monday, March 3	Supplementary applications	
4	Sec. 79	p. 260,1-6
5*	Review of applications	
6*	Review	
Monday, March 10*	Test III	
11*	Review	
12*	Review	
13*	Review	
Monday, March 17*	Final Examination	

McKeever +3
Longnecker +5

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 256 Differential Equations with Applications

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)

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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

A Report

on

Math 290 - 291 - 292 (1974-75)

Second Year of the Mathematics Honors Sequence

Arnold E. Ross

There are two basic concerns in the mathematical education of the very young interested in careers as engineers, scientists, mathematicians or in careers in any of the professions with a strong underpinning of mathematics and science. The first concern is with the need of developing those skills and attitudes of mind which go under the name of problem solving ability. The second concern is with the need to respond adequately to the changing demands upon mathematics by engineering, by the sciences and by the professions.

The second year honors program builds upon the skills and attitudes developed in the program during the first year. Notably among these--the development of problem solving ability, early and varied experience with vector methods, a very early introduction to complex numbers, experience in the study of the calculus from the constructive viewpoint of numerical analysis, and considerable involvement with geometric applications in two and three dimensions.

Continuing in the spirit of dovetailing the complex calculus and the real calculus whenever this is profitable, the course devotes the first half of the Autumn Quarter to functions of the complex variable using integration (after Cauchy) as the basic tool and proceeding as far as the residue theorem and its applications. In the second half of the Autumn Quarter we develop a geometric approach to the theory of nonlinear differential equations illustrating first the power of phase plane representation and resulting techniques in the simpler instance of linear equations. Here the student's experience with parametric representation of curves acquired in the freshman year comes in good stead.

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The first four weeks of the Winter Quarter were devoted to the usual treatment of differential equations, emphasizing the study of special types of equations and the methods of their solution. The remainder of the quarter was devoted to Linear Algebra and Matrix Theory with a strong emphasis throughout on the algorithms involved in the construction of canonical forms (Jordan, etc.) of matrices (linear transformations!). The Spring Quarter, by a request of the honors student group, was devoted to a deeper and more incisive study of limiting processes. We studied special important limits, infinite series with special attention to tests of convergence and to the behavior of power series. We studied the properties of expansions in orthogonal functions (particularly the case of Legendre polynomials and trigonometric Fourier series). Here we were helped by the insights acquired through a prior study of the limiting processes in metric spaces. We touched upon the use of power series in the solution of differential equations.

Throughout the course our first priority went to the need of a deep involvement of students in the ideas and methods which we dealt with and which are a fundamental part of scientific methodology. The scope of our study was limited only by the students' capacity to benefit from our studies at the present stage of their intellectual development. One should mention here that one of our important objectives was to make each student acquire a greater and greater capacity for initiative and an ever greater ability to approach new scientific questions independently.

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Mathematics 345 — Foundations of Higher Mathematics

Sp. 5 cr.

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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 (550), abstract algebra (580), linear algebra (571), 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, 1975

Mathematics 415

Ordinary and Partial Differential Equations

W., Sp. 5 cl.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

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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, 569, 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.

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 1975

*indicates topics which must be included

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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Mathematics 501 Fundamentals of Mathematics I

A. 4 cr.

Recommended prerequisites:

Catalog description:

501, 502 and 503 is an integrated sequence in 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.

Possible text(s):

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.

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Course coordinator: Eudora Huffman

Spring, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 504 — The History of Mathematics

A., W. 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 acceptable 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:

Follow-up courses:

This course is terminal.

Possible text(s):

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

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. (See attached sheet for possible term paper topics.)

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 (See attached sheets for books put on reserve. Note: There are many other good sources.)

Course coordinator: Charles Saltzer
Spring, 1975

Note: Copies of the above mentioned term paper topics and reserve books are on file in Joan Leitzel's office.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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.

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, 1975

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Mathematics 512

Partial Differential Equations and Boundary Value Problems

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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):

Miller, Partial Differential Equations in Engineering Problems, Prentice-Hall

Holl, Maple, and Vinograde, Introduction to Laplace Transform, Appleton-Century Crofts (out of print)

Wiley, Engineering Mathematics

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.

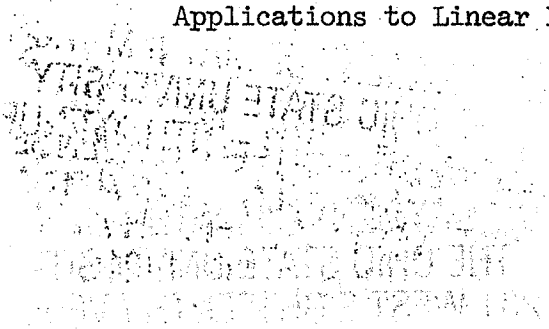
Fourier Series

Separation of Variables and Linear Partial Differential Equations

Definition and Elementary Properties (Laplace Transform)

Sufficient Conditions for Existence, Convolution Integral

Applications to Linear Partial Differential Equations



Course coordinator: J. T. Scheick

Spring, 1975

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Math 512 Partial Differential Equations and Boundary Value Problems

Texts: Partial Differential Equations in Engineering Problems - Miller
Introduction to Laplace Transform - Holl, Maple, Vinograde

1.	Trig. Fourier Series for (-L,L)	M.§29,30,17-19	pg. 84, #1-5,12
2.	Orthogonal Relations, finite series	M.§16	
3.	Even and Odd functions	M.§31,32,22,23	pg. 84, #7-10
4.	Prologonations	M.§33,24,25	#19-21
5.	Convergence Theorem (no proof)	M.§40,26	pg. 84, #6,22,46
6.	Complex Fourier Series	M.§36,37	pg. 84, #28-31
7.	Review		
8.	Test		
9.	Solution of Ordinary Differential Equations with Constant coef.		
10.	Vibrating String	M.§42,43	pg. 132, #4-6
11.	Steady State Heat	M.§45	#14,17,18
12.	Transmission line	M.§47	#23
13.	Non-homog. Bdy Cond. and superposition	M.§49	#24
14.	Uniqueness of Solution		#45
15.	Non-homog. Equations	M.§53	#39,40,42
16.	Review		
17.	Test		
18.	Laplace Trans., Linearity, Transforms of elementary functions	H.M.V. §1.1, 1.2	pg. 6, #1-5
19.	Translation, change scale, inverse	§1.3, 1.4	pg. 9, #1,3,5,6
20.	Transform of derivative	§1.5	pg. 13, #1-3
21.	Partial Fractions and inverse of rational functions	§1.7	pg. 31, #1-13 odd
22.	Sufficient conditions for L {f(t)} (no proof)	§2.2	pg. 38, #1-3
23.	Convolution integral	§2.4	pg. 49, #1,2
24. 25.	Solution of Ordinary linear diff. equations with const. coef.	§1.6	pg. 21, #1-11
26.	Test		
27.	Partial Transforms	§5.2	pg. 112, #1,2
28.	Semi-infinite string, finite string	§5.3, 5.4	pg. 116, #1,2
29.	Heat Conduction in a semi-infinite rod	§5.6	pg. 124, #1
30.	Review		

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 513 — Vector Analysis for Engineers

A., 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

Suggested course content:

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

(over)

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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 514 Complex Variables for Engineers

W., 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:

Possible text(s):

Churchill, Complex Variable and applications

Wiley, Engineering Math

Kreyzig, Engineering Math

Hauser, Complex Variables Tech Outlines

Derrick, Complex Variables

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)

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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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.

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

Spring, 1975

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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.

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, 1975

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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 (Especially written for this course.)

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Course coordinator: Leroy F. Meyers

Spring, 1975

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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 547 Introductory Analysis I

A., W. 3 cl.

Recommended prerequisites:

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

Catalog description:

547, 548, 549. A 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.

Course coordinator: David Dean

Spring, 1975

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 548 — Introductory Analysis II

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.

Course coordinator: David Dean

Spring, 1975

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 550 Advanced Calculus I

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

Recommended prerequisites:

Math 254

Purpose of course:

This course is designed to introduce students to topics in real analysis of one variable. Limit concepts are looked at carefully and the completeness property of the real number system is used extensively to develop proofs. Students are expected to be able to carry out proofs and apply the ideas learned to a wide range of examples.

Audience: The course is taken primarily by Math, Statistics, and CIS students.

The attitude is usually good although students seem to have a great deal of difficulty in making the transition from problem solving in the calculus to the greater demands placed upon them.

Follow-up Courses:

551.02, 552

Possible Texts:

Avner Friedman - similar title
Watson Fulks - Introduction to Analysis

Suggested course content:

Least upper bound axiom-real numbers, limit definitions for sequences and functions with consequences and applications, series of constants with various tests for convergence, sequences of functions and series of function, uniform convergence and its implications

Course coordinator: Henry Colson

Spring, 1975

Mathematics 551.01 Vector Analysis

Au., Su. 5 cl.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 551.02 Advanced Calculus II

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

Recommended prerequisites:

Math 550

Purpose of course:

The course continues as a follow-up to Math 550. Students are introduced to functions of more than one variable, integration, and transformation of variable theorems.

Audience:

Primarily math majors.

Possible texts:

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

Spring, 1975

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Mathematics 552.01 Complex Variables I

Su., W. 5 cl.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 552.02 Complex Variables I

Su., 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, 1975

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.

Mathematics 553 Complex Variables II

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Sp. 5 cl.

Recommended prerequisites:

Math. 552.01 or 552.02

Catalog description:

A continuation of 552.

REMARK: This course doesn't generate an audience, and has run only once since it got in the catalog.

Purpose of course:

Do more advanced topics in complex variables, of mutual interest to the students and the instructor.

Audience:

Variable.

REMARK: I believe the most likely audience would be engineers and scientists interested in techniques. If so, the following is how I would do it.

Possible text(s):

Dettman, Part II, Moretti, etc.

Suggested course content:

2 dimensional potential theory, Laplace and Fourier transforms, Special functions, steepest descents, asymptotic expansions.

Course coordinator: F. W. Carroll

Spring, 1975

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Mathematics 556 Differential Equations

A., Sp. 5 cr.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

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.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 557

Orthogonal Systems and Differential Equations.

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

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

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

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

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

(over)

Suggested course content:

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

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

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

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

Course coordinator: J. R. C. Leitzel

Spring, 1975

Mathematics 569 Linear Algebra II

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

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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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, 1975

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Mathematics 570 Elementary Modern Algebra

W., Sp. 5 cl.

Recommended prerequisites:

Junior standing
(Not recommended for mathematics majors intending to pursue graduate work in mathematics.)

Catalog description:

An introduction to abstract algebra with topics from elementary ring, field, and group theories; special emphasis on ring of integers, congruences, polynomial domains, permutation groups.

Purpose of course:

To give students a one quarter experience with algebraic structures. It is not intended to acquaint students with a large variety of algebraic ideas but some limited number of topics are chosen and pursued in reasonable depth.

Audience:

The audience is varied including some mathematical science majors, education majors and others. It is my feeling that the course is not appropriate for majors in mathematics. They should enroll in the 580 sequence whenever possible, taking as much of it as their schedules will allow.

Possible text(s):

J. Landin, An Introduction to Algebraic Structures

S. Lang, Algebraic Structures

R. Laatsch: Basic Algebraic Systems

Bunduck and Leesan: Essentials of Abstract Algebra (Winter, 1974)

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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Suggested course content:

This course is not prerequisite to any other so there is no constraint on the precise content of each section. It probably would be agreed that the fundamentals of group theory should be discussed and move out from there.

Course coordinator: J. R. C. Leitzel

Spring, 1975

Mathematics 571 Introduction to Linear Algebra

Su., W., 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

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 573 Elementary Number Theory

A., 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, 1975

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

Mathematics 575

Combinatorial Mathematics and Graph Theory

W. 5 cr.

Recommended prerequisites:

Math 571 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.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

(over)

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, 1975

Mathematics 576

Linear Algebra and Discrete Algebraic Structures

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.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

(over)

Background and attitude of audience:

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, 1975

Mathematics 577.01 — Linear Algebra and Discrete Algebraic Structures

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:

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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(over)

Possible text(s):

The present texts for the sequence 576-577.01 are

1. Schaum's Outline "Linear Algebra."

2. 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, 1975

Mathematics 577.02 Discrete Algebraic Structures

A. 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:

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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(over)

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, 1975

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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)

Catalog description:

The sequence 580, 581, 582 is an alternative to 570, 571, 573; an integrated sequence of topics from elementary number theory and algebraic structures.

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.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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, 1975

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NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

Mathematics 101.01 Basic Mathematics I

S., A., Sp. 3 cr.

Prerequisites:

Placement on basis of OSU Mathematics Placement Test

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:

Students are assigned to Math 101 only if scores on both the mathematics portion of the American College Test and the OSU Mathematics Placement Test show serious mathematical deficiencies. Students with Mathematics Placement Level V are automatically assigned to the reduced pace 101. The typical 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 159, 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.

Possible text(s):

Fraser, Elementary Algebra.

Course content:

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

Course coordinator: Joan Leitzel

Spring, 1975

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

A., W., Sp. 5 cl.

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.

NOTE: The exact content of this course and the order of presentation of the topics may vary, somewhat, from quarter to quarter. This syllabus describes the course as taught in recent quarters.

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.

Prepared by: J. R. C. Leitzel

Spring, 1975

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