DEPARTMENT OF MATHEMATICS

Chairperson of Department: PROFESSOR TALBOT; Professors: SAUNDERS, EMBREE; Associate Professor: GEWIRTZ, Assistant Professors: KOWARSKI, PARCHMENT, RAJANNA, SEELY; Instructors: HARVEY, DAVIS,* McMILLAN, WANG, WILLIAMSON; Lecturers: BOHUN-CHUDYNIV, ACKERMAN, BOWDEN, EDWARDS, GLADDEN, LEVEQUE, McNEILL, MODLIN, PROCTOR, RILEY, STILLS.

OBJECTIVES OF THE DEPARTMENT: It is the purpose of the department to assist students in developing an appreciation of the power, orderliness of thought, and precision of expression in mathematics and to provide training in mathematics necessary for the study of other subjects. In this process ideals of perfection as to logical structure and correct mental habits will be formed. Students who complete a major in the department may go into the teaching of mathematics on the secondary level or go into mathematics or computer related activities in government, business or industry. A proper distribution of courses will enable the student to meet admission requirements of graduate schools.

REQUIREMENTS FOR A MAJOR IN MATHEMATICS: Students desiring a major in mathematics must earn at least twenty semester hours of mathematics on 300 and 400 levels, and if he takes college mathematics courses before entering 1701.(50)241-1701.(50)242, he may follow either of two sequences: (1) Mathematics 1701.(50)111, 1701.(50)121, 1701.(50)126, 1701.(50)241-1701.(50)242, or (2) Mathematics 1701.(50)113, 1701.(50)114, 1701.(50)241, 1701.(50)242. In addition, the following courses must be completed: Mathematics 1701.(50)215, 1701.(50)304, 1701.(50)305; one course in algebra: Mathematics 1701.(50)311, 1701.(50)312 or 1701.(50)413; and one course in geometry: Mathematics 1701.(50)322 or 1701.(50)421; and one course from Mathematics 1701.(50)450, 1701.(50)451 or 1701.(50)452. In general, majors should complete Mathematics 1701.(50)242 by the end of the sophomore year and they usually will take considerably more courses in mathematics on the 1701.(50)300 level than required. The supporting courses are Physics 1902.(66)205-1902.(66)206. Majors are strongly urged to include among their electives two of the following languages: German, French, or Russian.

A student who has completed a year of high school algebra and a year of plane geometry should be prepared to pursue Mathematics 1701.(50)111, 1701.(50)113 or 1701.(50)121. The approval of the Mathematics Department is necessary in order to pursue Mathematics 1701.(50)215, 1701.(50)216 and any mathematics course numbered above 1701.(50)305. Only those students who maintain a high quality of work will be approved to pursue these courses. A grade of C or better is necessary for advancing in the mathematics sequences above 1701.(50)110.

Students are assigned beginning courses in mathematics according to their performance on the general classification test given to all entering freshmen during registration.

Qualified students who plan to major in mathematics, chemistry, biology, physics, economics, psychology, or science education should elect Mathematics 1701.(50)113-1701.(50)114. A student who receives credit for Mathematics

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*On leave '74-'75

1701.(50)113-1701.(50)114 cannot thereafter receive credit for Mathematics 1701.(50)111, 1701.(50)121 or 1701.(50)126. Also, a student cannot receive credit for Mathematics 1701.(50)110 if he has previously received credit for any course in Mathematics numbered above 1701.(50)110. High school deficiencies may be removed by passing Mathematics 1701.(50)110. In this case no college credit will be given.

Honors Program

After a student has completed Mathematics 1701.(50)215 and 1701.(50)242, he may be invited by the Department of Mathematics to study for honors. In order to be eligible for participation in this program, a student's scholastic standing in terms of grade or honor points shall not be less than 3.0 in general average and not less than 3.0 in all mathematics courses completed. The following mathematics courses on the upper level must be completed with high distinction: Mathematics 1701.(50)304, 1701.(50)305-1701.(50)306, 1701.(50)312, 1701.(50)413, 1701.(50)322 or 1701.(50)421, 1701.(50)451 or 1701.(50)452. It is recommended that both 1701.(50)451 and 1701.(50)452 be completed.

1701.(50)010, 50.020, 50.030, 50.040 COOPERATIVE WORK PROGRAM—*0 credit.*

1701.(50)107 FUNDAMENTALS OF MODERN MATHEMATICS—*Four hours; 3 credits.* Intended primarily for elementary education majors, this course covers sets, mathematical logic, structure of the number system, and the development of the principles of arithmetic and algebra from the laws of the number system.

1701.(50)108 FUNDAMENTALS OF MODERN MATHEMATICS—*Three hours; 3 credits.* A continuation of Mathematics 50.107, this course treats mathematical systems, topics from algebra, basic statistical measures, and intuitive geometry.

1701.(50)110 FUNDAMENTALS OF MATHEMATICS—*Four hours; 3 credits.* This course is designed for those students with limited mathematical background. Emphasis is placed upon teaching students how to study mathematics. Elementary mathematics will be reviewed from a modern point of view in which there will be a discussion of sets with application to geometry, number system, and algebraic structures.

1701.(50)111 COLLEGE ALGEBRA—*Three hours; 3 credits.* Quadratics, progressions, permutations, combinations, complex numbers, binominal theorem, determinants, and other selected topics will be presented in this course.

1701.(50)113 INTRODUCTION TO MATHEMATICAL ANALYSIS—*Four hours; 4 credits.* This is the first half of a unified course in modern college algebra, analytic trigonometry, and analytic geometry.

1701.(50)114 INTRODUCTION TO MATHEMATICAL ANALYSIS — *Four hours; 4 credits.* This course is a continuation of Mathematics 1701.(50)113. Prerequisite: Mathematics 1701.(50)113 with C or better.

1701.(50)121 PLANE TRIGONOMETRY—*Three hours; 3 credits.* The following topics will be included in this course; definitions and relations of trigonometric functions, logarithms, solutions of right and oblique triangles, trigonometric identities and equations.

1701.(50)126 ANALYTIC GEOMETRY—*Four hours; 4 credits.* This course includes a discussion of Cartesian coordinates, loci and their equations, translation and rotation of axes, parametric representation, polar coordinates, and loci in space.

1701.(50)151 INTRODUCTION TO COMPUTERS AND PROGRAMMING—*Four hours; 3 credits.* This course is designed as a beginning for students majoring in any field and for students planning further work in programming. It deals with organization and characteristics of computers, basic programming, and applications by the students to their areas of interest.

1701.(50)152 COMPUTERS AND PROGRAMMING—*Four hours; 3 credits.* This course deals with symbolic coding and assembly systems, procedure—oriented languages, and additional flow-diagramming techniques. Several projects will be undertaken to illustrate the principles and techniques. Prerequisite: Mathematics 1701.(50)151 with C or better.

1701.(50)215 FOUNDATIONS OF ANALYSIS AND SETS—*Three hours; 3 credits.* Elementary calculus of sets, axiomatic treatment of the number system and a brief introduction to the concepts of groups, rings, integral domains, fields and order properties will be included. Taken concurrently with or after 1701.(50)241 with C or better.

1701.(50)216 FOUNDATIONS OF ANALYSIS AND SETS—*Three hours; 3 credits.* As a continuation of Mathematics 1701.(50)215 the following topics will be included: Dedekind cuts; graphs and correspondences; functions and mappings; union, intersection and product of families of sets; coverings and partitions; and axiom of choice and Zorn's lemma. Prerequisite: Mathematics 1701.(50)215 and permission of instructor.

1701.(50)231 DATA STRUCTURES—*Three hours; 3 credits.* Basic concepts of data, linear lists, strings, arrays. Representation of trees and graphs. Storage systems and structures, data structures in programming languages and formal specification of data structures. Prerequisite: 1701.(50)152.

1701.(50)241 DIFFERENTIAL AND INTEGRAL CALCULUS — *Four hours; 4 credits.* This course develops the theory and formulae for differentiation and integration with applications to geometry and physics. Prerequisite: Mathematics 1701.(50)114 or 1701.(50)126.

1701.(50)242 DIFFERENTIAL AND INTEGRAL CALCULUS—*Four hours; 4 credits.* As a continuation of Mathematics 50.241 the following topics will be included: definite integrals, power series, multiple integrals, partial differentiation and simple differential equations. Prerequisite: Mathematics 1701.(50)241.

1701.(50)251 NUMERICAL METHODS AND PROGRAMMING—*Four hours; 3 credits.* This course is an introduction to numerical algorithms fundamental to scientific computer work. It includes solution of algebraic and transcendental equations, systems of linear equations, curvefitting, interpolation, differencing, numerical solution of differential equations, and error estimation. Computer solutions to problems will be attained by using an algebraic language. Prerequisites: Mathematics 1701.(50)151, 1701.(50)241, 1701.(50)242 and permission of the instructor.

1701.(50)304 INTRODUCTION TO DIFFERENTIAL EQUATION—*Three hours; 3 credits.* This is a first course dealing with methods of solving ordinary differential equations with application to geometry and physics. The following topics are included: equations of the first order and first degree; equations of the first order but not of the first degree; singular solutions; linear equations with constant and variable coefficients. Prerequisite: Mathematics 1701.(50)242.

1701.(50)305 ADVANCED CALCULUS—*Three hours; 3 credits.* The following topics will be in this course: limits and continuity, derivatives, Riemann integrals, uniform convergence, partial differentiation, line, surface and space integrals, improper integrals. Prerequisite: Mathematics 1701.(50)242.

1701.(50)306 ADVANCED CALCULUS—*Three hours; 3 credits.* This course is a study of elementary functions of a complex variable, Cauchy's integral theorem and formula, residues and poles, power series, introduction to the solutions of differential equations by series. Prerequisite: Mathematics 1701.(50)305.

1701.(50)312 INTRODUCTION TO MATRICES—*Three hours; 3 credits.* This course is a study of linear transformations and matrices, linear vector spaces, equivalent and canonical forms, quadratic and hermitian form, Cayley-Hamilton theorem, invariant factors and elementary divisors. Prerequisite: Mathematics 1701.(50)242.

1701.(50)322 SOLID ANALYTIC GEOMETRY—*Three hours; 3 credits.* This course leans heavily on determinant theory to discuss lines, planes and transformation of coordinates in space; quadric surfaces, the general equation of the second degree, and properties of quadrics. Prerequisite: Mathematics 1701.(50)242.

1701.(50)413 INTRODUCTION TO MODERN ALGEBRA—*Three hours; 3 credits.* In this course the number system and elementary theory of groups will be studied. Rings, integral domains, fields and ideals as well as an introduction to polynomials and matrices over a field will be considered. Prerequisite: Mathematics 1701.(50)215 and 300 level mathematics courses or by permission of the instructor.

1701.(50)421 HIGHER GEOMETRY—*Three hours; 3 credits.* This course introduces the student to projective, advanced Euclidean and non-Euclidean geometrics. Some topics discussed are transformation theory, projective theory of conics, Desargues' theorem, duality, projectivities; parabolic, hyperbolic and elliptic geometries. Prerequisite: Mathematics 1701.(50)126 with C or better or by permission of the instructor.

1701.(50)431 MATHEMATICAL THEORY OF STATISTICS—*Three hours; 3 credits.* An introduction to the probability theory necessary to serve as a basis for the study of statistics will be presented. The following topics will be included: graphical representation of frequency distributions; moments and moment generating functions; various special distribution functions including the Bernouilli, Poisson, rectangular and normal distributions; joint frequency functions, linear and multiple correlation and regression. Prerequisite: Mathematics 1701.(50)242 with C or better.

1701.(50)432 MATHEMATICAL THEORY OF STATISTICS—*Three hours; 3 credits.* This course is a continuation of Mathematics 50.431. The normal distribution, Student's distribution, the F-distribution, and the Chi-Square distribution will be studied. Principles of testing hypotheses and estimation will be considered as well as small sample theory.

The two courses in Mathematical Theory of Statistics are not a duplication of Psychology 2001.(70)316-70.317 or Economics 2204.(24)311-2204.(24)312, since Mathematics 1701.(50)431-50.432 emphasize the mathematical theory of statistics and require a knowledge of calculus as a prerequisite.

1701.(50)450 SENIOR SEMINAR—*Three hours; 3 credits.* The aim here is to aid the student in integrating his knowledge of mathematics and in developing to a higher level his problem-solving ability. Materials will be selected from a number of sources including courses required for a major and topics which are not part of any regular course. This course is required of senior mathematics majors who do not present credit in the conference course.

1701.(50)451 CONFERENCE COURSE—*3 credits.* This course is designed for seniors in the Honors Programs and others admitted by the chairman and is devoted to one or more topics in advanced mathematics. Much of the work is done through independent study with timely conferences with the instructor.

1701.(50)452 CONFERENCE COURSE—*3 credits.* This course is the same type as 1701.(50)451 and operates independently of 1701.(50)451.

1701.(50)471 NUMERICAL ANALYSIS AND PROGRAMMING—*Three hours; 3 credits.* This course covers methods for deriving numerical results for mathematical procedures with attention given to the precision of the results. Computer Programming techniques will also be included. Prerequisite: Mathematics 1701.(50)242 with C or better.

1701.(50)479 POINT SET TOPOLOGY—*Three hours; 3 credits.* The topics to be covered include point set theory of the line and plane, topological spaces and properties, mappings. Prerequisite: Mathematics 1701.(50)242 with C or better.

DEPARTMENT OF MATHEMATICS

A Suggested Course Outline for Mathematics Majors

tes to *Student*: (1) Advisors will help you select courses for your first year. They will
the record of courses taken previously, test scores, and your expressed interests.

The outline is a guide not a rigid pattern.

As you become better informed on what opportunities exist for graduate study
d/or employment after graduation, consult advisors on how adaptations might be
ide in your particular plan for studies.

Courses marked (H) are part of the Honors Program but may be taken by other
idents by permission of the instructor.

) If you plan to be a mathematics teacher, inform the Departmental Chairman to
at effect by the sophomore year.

Freshman Year

FIRST SEMESTER			SECOND SEMESTER		
urse No.	Title	Sem. Hrs.	Course No.	Title	Sem. Hrs.
00.(56)	Orientation	(1)			
10.(72)	Reading	1			
01.(30)100	English	3	1501.(30)102	English	3
01.(78)101*	Social Science	3	2201.(78)102	Social Science	3
37.(38)100	Health Education	2			
35.(60)	Physical Education	1	0835.(60)	Physical Education	1
701.(50)113**	Mathematics	4	1701.(50)114	Mathematics	4

One or more of the following courses:

iology 101		(4)	Biology 0401.(14)102		(4)
hemistry 101		(4)	Chemistry 1905.(22)102		(4)
iological Science 107		3	Biological Science 0834.(76)108		3
		17			14
					(31)

(Instead of Social Science 101-102, you may take 3 credits of Political Science 2207.(68) and 3 credits
of Sociology 2208.(80) and 3 credits of Economics 2204.(24) but we suggest that they be taken after
your first year.)

**(Instead of 1701.(50)113-1701.(50)114, one may take 1701.(50)111-1701.(50)121-1701.(50)126.
Depending on the courses for which the student is prepared, he may begin his college mathematics
with 1701.(50)113 or 1701.(50)111 or 1701.(50)121 or 1701.(50)126 or even 1701.(50)241, but not
1701.(50)114.)

(The only additional mathematics courses open to students who have not reached calculus are the
computer courses.)

(Physical Science will provide valuable knowledge, but it cannot replace Physics 205-206 which is
required of all mathematics majors. Neither can it replace Biology or Biological Science, one of
which is required for a degree.)

(The department recommends, but does not require, that majors have at least a reading knowledge of
at least two foreign languages: French, German or Russian.)

1975-76

Sophomore Year

FIRST SEMESTER			SECOND SEMESTER		
Course No.	Title	Sem. Hrs.	Course No.	Title	Sem. Hrs.
1701.(50)241	Mathematics	4	1701.(50)242	Mathematics	4
1701.(50)215	Mathematics	3	216	(H) Mathematics	3 (H)
4903.(44)201	Humanities	3	4903.(44)202	Humanities	3
2205.(40)201	History	3	2205.(40)202	History	3
0835.(60)	Physical Education	1		Electives	3-6
	Electives	3			17
		17			(34)

Junior Year

FIRST SEMESTER			SECOND SEMESTER		
Course No.	Title	Sem. Hrs.	Course No.	Title	Sem. Hrs.
1701.(50)304	Mathematics	3	1701.(50)305	Mathematics	3
1701.(50)305	Mathematics	3	1701.(50)306	(H) Mathematics	3(H)
1902.(66)205	Physics	5	1902.(66)206	Physics	5
	General Ed. Req.*	6		General Ed. Req.*	6
		17			17
					(34)

A geometry (1701.(50)322 or 1701.(50)421) 3 credits per course

*Two courses from special group of Art, Music, English, Humanities and Philosophy 3 credits per
course. See p. 61.

(Additional mathematics courses are available each year. Statistics, 1701.(50)431 and 1701.(50)432,
may be taken after completion of 1701.(50)242.)

Senior Year

FIRST SEMESTER			SECOND SEMESTER		
Course No.	Title	Sem. Hrs.	Course No.	Title	Sem. Hrs.
(1701.(50)312 or			1701.(50)452	(H) Mathematics	3 (H)
1701.(50)413)*	An algebra	3	1701.(50)450	Mathematics***	
1701.(50)450 or				Electives**	15
1701.(50)451	(H)Mathematics	3			18
1509.(58)402	Philosophy	2			(128)
	Electives**	9			
		17			

* Preferably both.
** 20 mathematics credits on 300 and 400 levels.
*** Given each semester.