Bulletin of the University of Wisconsin

Vol. 1955, No. 9 August, 1955

The Bulletin of the University of Wisconsin is published nine times annually: monthly January through June; twice in July; once in August; and is entered as second-class matter at the Post Office at Madison, Wisconsin, under the Act of Congress of August 12, 1912.

GENERAL ANNOUNCEMENT OF COURSES

1954-56

(CATALOG)

MADISON, WISCONSIN

U. Wisc. 1954-56

SLAVIC LANGUAGES

RUSSIAN

150. History of the Russian Language. Sem; 2 cr. Mr. Folejewski.

151. Slavic Phonetics. Sem; 2 cr. Mr. Folejewski.

170. Old Church Slavonic. Sem; 2 cr. Mr. Folejewski.

SPANISH AND PORTUGUESE

SPANISH

128. Spanish Historical Grammar. Yr; 2 cr. An introduction to Spanish philology. To be given 1955–56. Mr. Kasten.

255. Philological Seminar: Old Spanish. Yr; 2 cr. To be given 1954–55. Mr. Kasten.

258. Seminar in Historical Spanish Syntax and Lexicography. Sem; 2 cr. Chronological study of representative texts. Mr. Kasten.

259. Seminar in Modern Spanish Language. Yr; 2 cr. To be given 1955–56. Mr. Kasten.

273. Romance Philology. Yr; 2 cr. Mr. Kasten.

MATHEMATICS

Professors Bing, Bruck, Buck, Evans, Kleene, Langer, MacDuffee, *chairman*, Mayor, Schaeffer, Young; Associate Professors Eberlein, Hammer; Assistant Professors Curtis, Fullerton, Immel, Korevaar.

Only students who have had at least one unit of high-school algebra and one unit of geometry are eligible to enroll in courses in mathematics. Mathematics 1 is the most elementary course offered and is the only course open to students presenting the minimum high-school preparation of one unit of high-school algebra and one unit of geometry. Students presenting one and one-half or two units of high-school algebra should enroll in Mathematics 2 if they have not had a course in trigonometry, and in Mathematics 20 if they have had trigonometry. A placement examination is given to determine if they are qualified, or if they should transfer to a more elementary course. Mathematics 1 is not open, for credit, to students presenting more than three units of high-school mathematics.

In general, students are required to present one full year of mathematics to satisfy the mathematics option for the B.A. or B.S. degree. However, students in Letters and Science who have passed either Mathematics 2 or Mathematics 20 will be regarded as having fulfilled this option. Mathematics 7, which is required of students in the School of Commerce, may not be counted towards fulfilling the requirement of the mathematics option for the B.A. or B.S. degree.

Major in Mathematics. Students majoring in mathematics are required to take a year's course in the calculus, and, ordinarily, a year's course in physics, preferably Physics 31. The course in physics should be taken concurrently with or following the course in the calculus. In addition to these requirements the major comprises a minimum of 15 credits selected from the following courses: Mathematics 104, 106, 108, 111 or 112, 115, 116, 117, 118, 119, 120, 121, 122, 123, 133, 137, 138. (Students who are enrolled in the School of Education may count 3 credits of Education 93 as part of the 15 credits requirement.)

Students entering the junior class with advanced standing who expect to complete a major in mathematics in four semesters, should previously have completed their year's work in the calculus.

Three sample sequences of courses are listed below for the student's guidance. Sequence A is recommended for students interested in mathematics or physics. Sequence B is recommended for students interested

mended for students interested
recommended for prospective t
clude the basic courses required

Year	Semester
Freshman	I
	II
Sophomore	I
	II
Junior	I
	II
Senior	I
	II

A minimum of 80 credits in
Detailed programs covering
able at the departmental office
courses offered by other depa
sample sequences.

It is desirable for students
reading knowledge of French

Course in Applied Mathem

1. Introductory College
the fundamental operations
logarithms; variations; progr
high-school algebra and one
had two units of high-school

2. Introductory Mathema
induction; inequalities; functi
in algebra are included. Prer
of high-school algebra and or

7. Theory of Investment
and general annuities; specia
tion of bonds; computation
for students in the pre-com
requirement of the mathema

20. Calculus and Analyt
line, circle, and conics; polyn
with applications involving
and one-half units of high-
trigonometry.

21. Calculus and Analy
Differential and integral cal
tions to the physical and soc
Mathematics 20.

22. Calculus and Analy
Infinite series, including Ta
tiple integrals. Prerequisite:

24. Theory of Life Insu

U. Wisc. 1954-56

mended for students interested in mathematical statistics or actuarial work. Sequence C is recommended for prospective teachers of high-school mathematics. All three sequences include the basic courses required for the further study of either pure or applied mathematics.

Year	Semester	Sequences and Courses		
		A	B	C
Freshman	I	20	20	20
	II	21	21	21
Sophomore	I	22	22	22
	II	112, or 111, 106	106	106 or 30
Junior	I	113a or 120a, 115a	115a, 120a	115a, 120a
	II	113b or 120b, 115b	115b, 120b	115b or 120b
Senior	I	104a. 116a	118	108, 104a, or 118
	II	104b, 116b	137, 133	121 or 122 or 137

A minimum of 80 credits in subjects outside the major subject is required for graduation.

Detailed programs covering the work of all four years have been prepared and are available at the departmental office. These programs meet the degree requirements and include courses offered by other departments which integrate significantly with one of the above sample sequences.

It is desirable for students who plan to take graduate work in mathematics to acquire a reading knowledge of French and German at the earliest possible time.

Course in Applied Mathematics and Mechanics. (See page 49.)

ELEMENTARY COURSES

1. Introductory College Algebra. I, II; 4 cr. Development of the number system and the fundamental operations of algebra; linear and quadratic equations; exponents and logarithms; variations; progressions; the binomial theorem. Prerequisites: One unit of high-school algebra and one unit of geometry. Not open, for credit, to students who have had two units of high-school algebra.

2. Introductory Mathematical Analysis. I, II; 4 cr. Plane trigonometry; mathematical induction; inequalities; functional variation and graphical analysis. Necessary review topics in algebra are included. Prerequisites: Mathematics 1; or at least one and one-half units of high-school algebra and one unit of geometry.

7. Theory of Investment. I, II; 4 cr. Simple and compound interest; annuity symbols and general annuities; special kinds of annuities; amortization and sinking funds; valuation of bonds; computation of depreciation. Prerequisite: Mathematics 1 or 2. Primarily for students in the pre-commerce sequence. May not be counted towards fulfilling the requirement of the mathematics option for the B.A. or B.S. degree.

20. Calculus and Analytic Geometry. I, II; 4 cr. Analytic geometry of the straight line, circle, and conics; polynomials and their graphs; elements of the differential calculus, with applications involving polynomials. Prerequisites: Mathematics 2; or at least one and one-half units of high-school algebra, one unit of geometry, and one-half unit of trigonometry.

21. Calculus and Analytic Geometry. I, II; 4 cr. Continuation of Mathematics 20. Differential and integral calculus of algebraic and transcendental functions with applications to the physical and social sciences; further topics in analytic geometry. Prerequisite: Mathematics 20.

22. Calculus and Analytic Geometry. I, II; 4 cr. Continuation of Mathematics 21. Infinite series, including Taylor's series; solid analytic geometry; partial derivatives; multiple integrals. Prerequisite: Mathematics 21.

24. Theory of Life Insurance. I, II; 3 cr. An introduction to the mathematics of life

U. Wisc. 1954-56

insurance. Mortality tables, net premiums, reserves, non-forfeiture benefits, gross premiums. Prerequisites: Two courses in mathematics.

30. Elementary Statistical Analysis. Sem; 3 cr. Elements of probability theory; collection and presentation of sample data; basic problems of statistical inference; applications, including quality control; linear regression, and correlation; simple distribution-free tests. Prerequisite: Mathematics 20 or 52 or the equivalent. Mathematics 30 is a basic course intended chiefly for freshmen and sophomores.

50. Sub-Freshman Algebra. I; 0 cr. A non-credit review of high-school algebra for engineering students who fail the examination for admission to Mathematics 51.

51. Elementary Mathematical Analysis. I, II; 5 cr. Plane trigonometry, mathematical induction; inequalities; functions, functional variation, and graphical analysis; theory of equations. Some topics in elementary algebra are reviewed briefly. Prerequisites: At least one and one-half units of high-school algebra and one unit of geometry, and passing of a placement examination in algebra. Not open to students who have passed Mathematics 2.

52. Elementary Mathematical Analysis. I, II; 5 cr. An introduction to differential and integral calculus and plane analytic geometry. Prerequisite: Mathematics 51 or 2.

INTERMEDIATE AND ADVANCED COURSES

Most of these courses are offered every year; the others when student needs warrant them.

101a. Calculus. I, II; 4 cr. (Intended only for students transferring from other institutions.) Functions, limits, and derivatives; differentiation of algebraic functions; differentials; integrals; differentiation of transcendental functions; applications. Prerequisite: A course in analytic geometry.

101b. Calculus. I, II; 4 cr. Techniques of integration; partial derivatives; multiple integrals with applications to physics; infinite series. Prerequisite: Mathematics 101a.

102a. Calculus. I, II; 4 cr. Continuation of Mathematics 52. Transcendental functions; techniques of integration; vectors and parametric equations. Prerequisite: Mathematics 52.

102b. Calculus. I, II; 4 cr. Continuation of Mathematics 102a. Solid analytic geometry and vectors; partial derivatives; multiple integrals; infinite series. Prerequisite: Mathematics 102a.

104. Theoretical Mechanics. Yr; 3 cr. Statics and dynamics of a particle and of a rigid body. Prerequisite: Mathematics 22 or a year of calculus.

106. Advanced Analytic Geometry. II; 3 cr. Advanced topics in plane analytic geometry and a treatment of solid analytic geometry. Prerequisite: A semester of calculus or concurrent registration in Mathematics 21 or 102a.

108. College Geometry. I; 3 cr. Advanced topics in Euclidean geometry including constructions, properties of triangles, coaxal circles, inversion. Open to juniors and seniors. (Of interest to teachers in secondary schools.) Prerequisite: Consent of instructor.

111. Applied Differential Equations. Sem; 3 cr. Ordinary differential equations and their applications, particularly equations of the first order and linear equations of the second order; systems of equations, series solutions, and numerical methods.

112. Differential Equations. II; 3 cr. A first course in differential equations. Methods of solution for equations of various types. Prerequisite: Mathematics 22 or a year of calculus.

113a. Applied Mathematical Analysis. I; 3 cr. Selected topics in advanced calculus;

introduction to complex varia
cations are stressed. Prerequi

113b. Applied Mathemati
differential equations; Fourie
gendre's functions; complex v

115a. Theory of Equatio
cals, approximate methods, r
site: A year of calculus or co

115b. Determinants and
tions, quadratic forms. Prere

116a. Higher Analysis. I;
mapping; complex integrals;

116b. Higher Analysis. I
Prerequisites: Mathematics 1

117. Vector Analysis. Ser
to analysis, geometry, and ph

118. Introduction to thi
basic laws of probability; m
Laplace, Bayes; probability i
Prerequisite: Mathematics 2

119. Differential Geome
ential methods. Prerequisite

120a. Advanced Calculus
tions, Taylor's Theorem, infi
series, functions of several v

120b. Advanced Calculus
applications, implicit functi
integrals, Beta and Gamma

121. Elementary Plane
applications of these propert
calculus.

122. Projective Geometr
well as the synthetic metho
requisite: Consent of instru

123. Convex Figures and
the simplest geometrical pr
fundamental inequalities in
of instructor.

131. Theory and Operat
tion of modern computing
card machines. Programmin
Prerequisites: Mathematics

133. Finite Differences
matical tables, numerical so
of equations, numerical eval
calculus.

137. Introduction to M

U. Wisc. 1954-56

introduction to complex variables.; the Laplace transform; vector analysis. Physical applications are stressed. Prerequisite: Mathematics 111 or 112, or equivalent.

113b. APPLIED MATHEMATICAL ANALYSIS. II; 3 cr. Continuation of course 113a. Partial differential equations; Fourier series and integrals; gamma functions; Bessel's and Legendre's functions; complex variables. Prerequisite: Mathematics 113a.

115a. THEORY OF EQUATIONS. I; 3 cr. Solution of cubic and quartic equations by radicals, approximate methods, resultants, and discriminants, symmetric functions. Prerequisite: A year of calculus or concurrent registration in Mathematics 22.

115b. DETERMINANTS AND MATRICES. II; 3 cr. Matrices, determinants, systems of equations, quadratic forms. Prerequisite: Mathematics 115a or consent of instructor.

116a. HIGHER ANALYSIS. I; 3 cr. Elementary functions of a complex variable; conformal mapping; complex integrals; the calculus of residues. Prerequisite: Mathematics 120a.

116b. HIGHER ANALYSIS. II; 3 cr. Partial differential equations of mathematical physics. Prerequisites: Mathematics 111 (or 112) and 120a.

117. VECTOR ANALYSIS. Sem; 3 cr. The algebra and calculus of vectors with applications to analysis, geometry, and physics. Prerequisite: Mathematics 22 or a year of calculus.

118. INTRODUCTION TO THE THEORY OF PROBABILITY. I; 3 cr. Combinatorial methods; basic laws of probability; mathematical expectation; theorems of Tchebycheff, Bernoulli, Laplace, Bayes; probability in continuum; sampling. Applications to physics and statistics. Prerequisite: Mathematics 22 or a year of calculus.

119. DIFFERENTIAL GEOMETRY. II; 3 cr. The theory of curves and surfaces by differential methods. Prerequisite: Mathematics 22 or a year of calculus.

120a. ADVANCED CALCULUS. I; 3 cr. Review of elementary calculus, hyperbolic functions, Taylor's Theorem, infinite series, uniform convergence, improper integrals, Fourier series, functions of several variables. Prerequisite: Mathematics 22 or a year of calculus.

120b. ADVANCED CALCULUS. II; 3 cr. Continuation of Mathematics 120a. Geometric applications, implicit functions, transformation of multiple integrals, line and surface integrals, Beta and Gamma functions. Prerequisite: Mathematics 120a.

121. ELEMENTARY PLANE TOPOLOGY. Sem; 3 cr. A study of properties of plane sets and applications of these properties to the calculus. Prerequisite: Mathematics 22 or a year of calculus.

122. PROJECTIVE GEOMETRY. II; 3 cr. The extension of elementary analytic methods as well as the synthetic method. Applications to rectilinear figures and conic sections. Prerequisite: Consent of instructor.

123. CONVEX FIGURES AND INEQUALITIES. Sem; 3 cr. An introductory course dealing with the simplest geometrical properties of convex figures and with their applications to the fundamental inequalities in use in everyday mathematical analysis. Prerequisite: Consent of instructor.

131. THEORY AND OPERATION OF COMPUTING MACHINES. Sem; 3 cr. Theory and operation of modern computing machines of intermediate complexity, particularly punched card machines. Programming of typical problems from statistics and the natural sciences. Prerequisites: Mathematics 22 or a year of calculus, and consent of instructor.

133. FINITE DIFFERENCES AND INTERPOLATION. II; 3 cr. Construction and use of mathematical tables, numerical solution of algebraic and transcendental equations and systems of equations, numerical evaluation of integrals. Prerequisite: Mathematics 22 or a year of calculus.

137. INTRODUCTION TO MATHEMATICAL STATISTICS. II; 3 cr. Derived distributions: chi-

U. Wisc. 1954-56

square, t, and F; estimation, confidence intervals; statistical tests; operating characteristics; regression; analysis of variance. Prerequisites: Mathematics 22, 102b, or 101b, and either Mathematics 118 or a course in applied statistics.

138. ACTUARIAL MATHEMATICS. Sem; 3 cr. Problems in finite differences, probability and statistics with particular emphasis on applications to life insurance. Prerequisite: At least a year of calculus or Mathematics 22.

GRADUATE COURSES

The graduate courses in mathematics are varied from year to year according to the needs of the students, other subjects being occasionally introduced in addition to those here listed. Standard courses will be given quite regularly and others when student needs warrant. Any course having the word "topics" in its title may have different content in successive semesters, and in such a case may be taken more than once. Enrollment in any graduate course requires the consent of the instructor.

201. TOPICS IN APPLIED MATHEMATICS. Sem; 3 cr.

202. ENTIRE FUNCTIONS. Sem; 3 cr. Chiefly the theory of functions of exponential type, with applications to the study of general interpolation series, the completeness of sets of functions, and Bernstein's theorems and their generalizations. Prerequisite: One semester of complex function theory.

215. TOPOLOGICAL ALGEBRA. Sem; 3 cr. Topological algebras and their applications to modern analysis. Prerequisite: Functions of a real variable and modern algebra, or consent of instructor.

216. TOPOLOGICAL GROUPS. Sem; 3 cr. Introduction to topological groups: groups, topological spaces, topological groups, compact groups, representations.

217. TENSOR ANALYSIS. Sem; 3 cr. The algebra and calculus of tensors with particular emphasis on their applications to the theory of relativity.

218. INTRODUCTORY TOPOLOGY. Yr; 3 cr. Axiomatic treatment of topological spaces. Transformations. Convergence. Metric spaces, continuous curves, and Euclidean spaces.

219. DIFFERENTIAL GEOMETRY. Sem; 3 cr. Curves and surfaces in three dimensions by classical methods. An introduction to corresponding problems in n-dimensions involving tensor methods.

220. THEORY OF ANALYTIC FUNCTIONS. Yr; 3 cr. This course is fundamental for analysis. Functions of the complex variable.

221. THEORY OF FUNCTIONS OF A REAL VARIABLE. Yr; 3 cr. Fundamental concepts of analysis, including the real number system, point sets, series, functions, derivatives, Riemann and Lebesgue integrals.

223. ALGEBRAIC TOPOLOGY. Sem; 3 cr. An investigation of the topological properties of certain types of spaces arising from their homology and homotopy groups and other algebraic systems associated with them.

224. TOPICS IN TOPOLOGY. Sem; 3 cr.

225. DIVERGENT SERIES. Sem; 3 cr. A course dealing with the classical methods of summation, their generalizations, and their many applications.

230. TOPICS IN THE FOUNDATIONS OF MATHEMATICS. Sem; 3 cr. A critical analysis of the foundations of mathematics, particularly of recursive number theory, with emphasis on the structure of mathematical reasoning.

231. THEORY OF PROBABILITY. Sem; 3 cr. Measure-theoretic foundations and modern analytical methods of the theory of probability.

232. TOPICS IN PROBABILIT
the students enrolling.

237. MATHEMATICAL STATI
non-parametric inference. Pr

238. TOPICS IN MATHEMAT
to suit the requirements of t
consent of instructor.

239. THEORY OF GAMES.
Games, with emphasis on th
problems of strategy, and to t

243. MODERN THEORY OF
equations in real variables.
conditions, the Green's functi
course in differential equatio

244. TOPICS IN ORDINARY
miliarity with the theory of

246. THEORY OF GROUPS.
important modes of represe
other branches of mathemati

249. THEORETICAL HYDROD
airfoil theory; viscous fluids.

251. POTENTIAL THEORY.
lems, Newtonian potentials.

261. ABSTRACT ALGEBRA.
Galois fields, and matrices, w

263. HIGHER ALGEBRA. Ser
ratic and Hermitian forms, e

264. RINGS AND FIELDS. S
ideals. Prerequisite: Normal

265. FOURIER ANALYSIS. S
equations of ordinary occurre
function, Hermite polynomia

266. TOPICS IN THE THEOR
ern theory of numbers, prese

267. CALCULUS OF VARIATI
cal theory and problems. Pr

268. PARTIAL DIFFERENTIA
equations of the first order a

269. THEORY OF INTEGRAL
approach to the equations o

270. LINEAR TRANSFORMA
dimensional generalization
Linear transformations, proj

271. LINEAR ALGEBRAS. S
of finite order and their ass
261.