

MATHEMATICS

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FINAL EXAMINATIONS IN MATHEMATICS

All candidates for a bachelor's degree whose major subject is mathematics will be expected to pass a general examination in that subject in lieu of the examinations of the special courses of their final half-year. The examination will be partly written and partly oral, and will include the following subjects:

1. Geometry of the plane and of space, both analytic and projective.
2. The differential and integral calculus, including the elements of differential equations.
3. Algebra: theory of algebraic equations.

Students who wish to offer mathematics as a major subject must obtain permission from the department. They should elect courses 5, 6, 8, and 9 in the lower division, and must include courses 109, 111, 112, 114, and 119. Physics 105 may be included.

The department will recommend for honors at graduation students whose work in the upper division courses and in the final examination has been of distinguished excellence.

Teacher's Certificates.—Candidates for the teacher's certificate are strongly recommended to elect courses 101A-101B, 102A-102B, or course 218A-218B. Course 6 will be required of all candidates for the cer-

tificate. The department will exact a practical test of the candidate's ability to present a clear and interesting exposition of subjects taught in the high school. Candidates who have not already passed the final examination in mathematics described above must pass that examination before being recommended for the teacher's certificate, unless they have passed with at least second grade courses 101A-101B, 102A-102B.

The University library contains an excellent collection of standard and current works in all branches of mathematics, including complete sets of nearly all the mathematical periodicals and the publications of learned societies. The department has also a good collection of geometrical models.

LOWER DIVISION COURSES

- A. Graphic Algebra. Dr. WRIGHT, Dr. ANDREWS, Mr. LEVY, and Mr. McCARTY.
 2 hrs., either half-year. Tu Th, 10, 11. Course A is equivalent to matriculation subject 4a¹.
- B. Solid and Spherical Geometry. Assistant Professor McDONALD.
 2 hrs., either half-year. First half-year, Tu Th, 9; second half-year, Tu Th, 10. Course B is equivalent to matriculation subject 4b.
- C. Plane Trigonometry. Associate Professors NOBLE and PUTNAM, Dr. BERNSTEIN, Dr. WRIGHT, Dr. ANDREWS, Mr. WAPPLE, Mr. LEVY, and Mr. McCARTY.
 2 hrs., either half-year. Tu Th, 9, 10, 11. Course C is equivalent to matriculation subject 12a².
- F. Algebraic Theory. Dr. WRIGHT.
 Equivalent to matriculation subject 4a². Prerequisite: matriculation subject 4a¹. Open only to students in the colleges of engineering.
 2 hrs., either half-year. Tu Th, 11.
- L. Elements of Analysis. Associate Professor LEHMER.
 Fundamental ideas of algebra, trigonometry, analytic geometry, and differential and integral calculus.
 5 hrs., first half-year. M Tu W Th F, 2.
- 2A-2B. Mathematical Theory of Investment. Dr. IRWIN.
 2 hrs., throughout the year. Tu Th, 10. Prerequisite: courses A, C, and F. Prescribed in the College of Commerce.
- 3-4. Elements of Analysis, with Applications. Professor EDWARDS, Associate Professors LEHMER and NOBLE, Dr. IRWIN, Dr. BUCK, Dr. BERNSTEIN, Dr. WRIGHT, Dr. ANDREWS, Mr. WAPPLE, Mr. LEVY, and Mr. McCARTY.
 A practical two-year course in algebra, analytic geometry, the differential and integral calculus, adapted particularly to the needs of students in engineering, architecture, and chemistry.

3A-3B.

3 hrs., throughout the year, beginning either half-year. M W F, 8, 9, 10.

3AB.

6 hrs., second half-year. Daily at 10. For freshmen entering in January only.

4A-4B.

3 hrs., throughout the year, beginning either half-year. M W F, 8, 9, 10.

5. Plane Analytic Geometry.

Assistant Professor McDONALD and Dr. ANDREWS.

The straight line, the circle, and the conic sections, including a discussion of the general equation of the second degree.

3 hrs., either half-year. M W F, 2. Prerequisite: courses A and C.

6. Introduction to Projective Geometry.

Associate Professor LEHMER and Assistant Professor WOODS.

3 hrs., either half-year. First half-year, M W F, 10; second half-year, M W F, 3. Course 6 includes matriculation subject 12a'. Required of all candidates for the teacher's certificate.

8. College Algebra.

Dr. BUCK and Dr. ANDREWS.

3 hrs., either half-year. First half-year, Tu Th S, 9; second half-year, M W F, 3. Prerequisite: courses A and C.

9. Differential Calculus.

Professor HASKELL and Associate Professor PUTNAM.

3 hrs., either half-year. First half-year, M W F, 9; second half-year, M W F, 10. Prerequisite: course 5.

UPPER DIVISION COURSES

These courses are open to students in the lower division who have the necessary prerequisites.

FREE ELECTIVE COURSES

16. Mathematical Theory of Investment. Associate Professor PUTNAM.
2 hrs., second half-year. M W, 11.

20. Theory of Probabilities: Elementary Course. Mr. MICHELBACHER.
3 hrs., first half-year. M W F, 8.

*22. History of Mathematics. Professor HASKELL.
2 hrs., second half-year. Tu Th, 11.

* Not to be given, 1915-16.

MAJOR COURSES

101A-101B. Elementary Geometry for Advanced Students.
Assistant Professor McDONALD.

An historical and critical review of elementary geometry from the earliest times to the present, with particular emphasis on recent developments.

3 hrs., throughout the year. M W F, 9. Prerequisite: courses 5 and 6.

102A-102B. Elementary Algebra and Analysis for Advanced Students.
Associate Professor NOBLE.

An historical and critical account of the development of algebra and analysis from the Middle Ages to the present, with particular reference to modern points of view.

3 hrs., throughout the year. M W F, 2. Prerequisite: courses 8 and 9.

109. Integral Calculus.
Associate Professor PUTNAM and Assistant Professor McDONALD.

3 hrs., either half-year. First half-year, M W F, 10; second half-year, M W F, 9. Prerequisite: course 9.

110A. Advanced Calculus.

Professor EDWARDS, Assistant Professor WOODS and Dr. BUCK.

The differential equations, both ordinary and partial, which occur most frequently in the applications, with special stress on approximate numerical solutions. Primarily for students of engineering.

2 hrs., first half-year. Tu Th, 8, 9, 10.

110B. Advanced Calculus.

Professor EDWARDS, Assistant Professor WOODS and Dr. BUCK.

Definite integrals, multiple integrals, theory and use of infinite series, applications to practical problems. Primarily for students of engineering.

2 hrs., second half-year. Tu Th, 8, 9, 10.

111. Determinants and Theory of Numerical Equations.
Associate Professor PUTNAM.

3 hrs., first half-year. M W F, 10.

112. Analytic Geometry of Three Dimensions. Dr. IRWIN.

3 hrs., first half-year. M W F, 2.

113. Synthetic Projective Geometry. Dr. WRIGHT.

3 hrs., first half-year. M W F, 9. Prerequisite: course 6.

114. Analytic Geometry. (Advanced Course.) Dr. IRWIN.

Introduction to modern methods in analytic geometry, especially with reference to algebraic plane curves.

3 hrs., second half-year. M W F, 2. Prerequisite: course 5.

115. Theory of Numbers. Dr. WRIGHT.
Elementary properties of numbers, theory of congruences, residues of powers, primitive roots, quadratic forms.
3 hrs., second half-year. M W F, 9.
- *116. Quaternions. Professor HASKELL.
3 hrs., first half-year. M W F, 3.
- *117. Calculus of Finite Differences. Assistant Professor BROOKS.
2 hrs., second half-year. Tu Th, 10. Prerequisite: course 109.
- 118A-118B. Algebra of Logic. Dr. BERNSTEIN.
3 hrs., throughout the year. M W F, 9.
119. Introduction to Differential Equations. Assistant Professor McDONALD.
3 hrs., second half-year. M W F, 3.
120. Theory of Probabilities: Advanced Course. Mr. MICHELBACHER.
3 hrs., second half-year. M W F, 8. Prerequisite: course 20 and a thorough course in calculus.

GRADUATE COURSES

- 201-202. Mathematical Seminar. Assistant Professor McDONALD.
Advanced students will be guided in reading and research. Frequent reports will be required, and the particular aim of the seminar is the training of students in independent investigation.
Tu Th, 10, and special appointments. Credit value, 3 to 5 units each half-year, dependent on amount and quality of work done.
- 218A-218B. Logic of Mathematics. Dr. BERNSTEIN.
Analysis of the foundation principles of geometry and algebra.
2 hrs., throughout the year. Tu Th, 9. Designed especially for teachers and prospective teachers of mathematics.
222. Theory of Functions of a Real Variable. Dr. IRWIN.
3 hrs., first half-year. M W F, 3.
223. Partial Differential Equations. Assistant Professor WOODS.
The important partial differential equations of applied mathematics.
3 hrs., second half-year. M W F, 2.
224. Theory of Functions of a Complex Variable. Professor EDWARDS.
3 hrs., first half-year. M W F, 10.

* Not to be given, 1915-16.

- *225. Elliptic Functions. Associate Professor NOBLE.
3 hrs., second half-year. M W F, 2.
- *227. Differential Geometry. Dr. BUCK.
Application of differential and integral calculus to curves and surfaces.
3 hrs., second half-year. Professor HASKELL.
- 228A-228B. Modern Analytic Geometry. Professor HASKELL.
3 hrs., throughout the year. M W F, 3. Associate Professor LEHMER.
- *231. Theory of Numbers. Professor HASKELL.
3 hrs., first half-year. M W F, 9.
- *233. Theory of Groups. Part I. Professor HASKELL.
Theory of groups of substitution, with application to the theory of algebraic equations.
3 hrs., first half-year. Hours to be arranged.
- *234. Theory of Groups. Part II. Professor HASKELL.
Elements of continuous groups, with application to the theory of differential equations.
3 hrs., second half-year. Hours to be arranged.
235. Seminar in Group-theory. Professor HASKELL.
Hours and credit to be arranged.
237. Calculus of Variations. Associate Professor NOBLE.
3 hrs., second half-year. M W F, 2.

COURSES IN OTHER DEPARTMENTS

- Analytic Mechanics. [See Physics 105.] Professor SLATE.
- Method of Least Squares. [See Astronomy 107.] Dr. EINARSSON.
- Interpolation, Use of Tables and Mechanical Quadratures. [See Astronomy 108.] Dr. NICHOLSON.
- Theoretical Astronomy. [See Astronomy 206.] Professor LEUSCHNER.
- Descriptive Geometry. [See Drawing 2.] Associate Professor KOWER and Assistant Professor WYTHE.

* Not to be given, 1915-16.