

1906-06

Berkeley

MATHEMATICS.

- IRVING STRINGHAM, Ph.D., Professor of Mathematics.
- GEORGE C. EDWARDS, Ph.B., Associate Professor of Mathematics.
- MELLEN W. HASKELL, Ph.D., Associate Professor of Mathematics.
- ERNEST J. WILCZYNSKI, Ph. D., Assistant Professor of Mathematics.
- CHARLES A. NOBLE, Ph.D., Assistant Professor of Mathematics.
- ALBERT W. WHITNEY, A.B., Assistant Professor of Mathematics.
- DERRICK N. LEHMER, Ph.D., Assistant Professor of Mathematics.
- THOMAS M. PUTNAM, Ph.D., Instructor in Mathematics.
- JOHN H. McDONALD, Ph.D., Instructor in Mathematics.
- BURT L. NEWKIRK, Ph.D., Instructor in Mathematics, Watson Assistant in Astronomy.
- ALFRED J. CHAMPREUX, B.S., Assistant in Mathematics.

Students in the College of Letters, or of Social Sciences, or of Natural Sciences, must include the subject of Analytic Geometry as an essential part of their programme of mathematical studies. They may satisfy this prescription by electing Course 1 in their Freshman year; but Course 1 should not be chosen as a preparation for more advanced courses, and students who desire to continue their mathematical studies beyond the first year should elect Courses C and 5, instead of Course 1. Course B is strongly recommended as an additional elective to all students who have not already studied solid geometry.

Course 2A is prescribed to Freshmen, and Course 2B to Sophomores in the College of Commerce; Course 3A to Freshmen and Course 3B to Sophomores in the Colleges of Engineering; Course 4A to Freshmen and Course 4B to Sophomores in the College of Chemistry; Course 19A to Juniors in the College of Mechanics.

Students in the College of Agriculture may elect any combination of at least six units which includes analytic geometry.

Students wishing to make a specialty of Mathematics should elect Courses C and 5 in the Freshman year, and should consult the members of the department as early as possible.

The Upper Division. Courses C, 5, 8, and 9A are prerequisite to work in the Upper Division.

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Teachers' Certificates. The department will, in general, recommend as qualified to teach mathematics in high schools only such graduates as have passed with credit in at least eighteen units of Upper Division work, including Course 18. The department reserve the right to exact a practical test of the candidate's ability to present a clear and interesting exposition of subjects taught in the high school.

LOWER DIVISION COURSES.

A. Elementary Algebraic Theory.

Assistant Professors NOBLE and LEHMER. Mathematical Induction, the remainder and factor theorems, the binomial theorem for positive integral exponents, theory of indices, theory of quadratic equations, simultaneous quadratic equations, the progressions, and other simple series.

2 hrs., either half-year. Tu, Th, 9. Course A is equivalent to admission requirement 4a, and is prerequisite to Course 8.

B. Solid and Spherical Geometry.

Associate Professor EDWARDS and Dr. McDONALD. The fundamental propositions of the Euclidean geometry of space.

2 hrs., either half-year. Tu Th, 9, 10. Course B is equivalent to admission requirement 4b.

C. Plane and Spherical Trigonometry.

Assistant Professor WILCZYNSKI, Dr. PUTNAM, Dr. NEWKIRK. The development of the general formulae of trigonometry. Practice in the use of logarithmic tables. Applications of trigonometry to the solution of triangles and to mensuration in general.

3 hrs., either half-year. M W F, 10; Tu Th S, 9, 10.

1. Elements of Analysis. Associate Professor HASKELL, and Assistant Professor WILCZYNSKI.

The methods of higher algebra, plane trigonometry, analytic geometry, and the differential and integral calculus, with some account of their historical development.

3 hrs., throughout the year. M W F, 10, 3. Prescribed (alternatively with Courses C and 5) to Freshmen in the Colleges of Letters, Social Sciences, and Natural Sciences.

C

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See 101

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2. Elements of Analysis.

Assistant Professor WHITNEY.

Plane trigonometry, advanced algebra, analytic geometry, and elements of the differential and integral calculus, with applications to problems in Economics.

2A. 3 hrs., throughout the year. M W F, 10. Prescribed to Freshmen in the College of Commerce.

2B. 2 hrs., throughout the year. Tu Th, 10. Prescribed to Sophomores in the College of Commerce.

ELEMENTS OF ANALYSIS, WITH APPLICATIONS.

A practical course in spherical trigonometry, algebra, analytic geometry, the differential and integral calculus, adapted particularly to the needs of students in Engineering and Chemistry.

3A. First Course.

Associate Professor EDWARDS.

Assistant Professors NOBLE, WHITNEY, and LEHMER, Dr. PUTNAM, Dr. McDONALD, and Dr. NEWKIRK.

3 hrs., throughout the year, beginning either half-year. M W F, 9, 10. Prescribed, Freshman year, in the Colleges of Engineering.

3B. Second Course.

Associate Professor EDWARDS,

Assistant Professors NOBLE and LEHMER,

Dr. PUTNAM, Dr. McDONALD, and Dr. NEWKIRK.

5 hrs., throughout the year, beginning either half-year. M Tu W Th F, 8. Prescribed, Sophomore year, in the Colleges of Engineering.

4A. First Course.

Mr. CHAMPREUX.

5 hrs., throughout the year. M Tu W Th F, 8. Prescribed, Freshman year, in the College of Chemistry.

4B. Second Course.

Mr. CHAMPREUX.

3 hrs., throughout the year. M W F, 9. Prescribed, Sophomore year, in the College of Chemistry.

5. Plane Analytic Geometry.

Professor STRINGHAM,

Associate Professor HASKELL, Assistant Professor WILCZYNSKI, Dr. PUTNAM and Dr. NEWKIRK.

The analytic geometry of the straight line, the circle, and the conic sections, including a discussion of the general equation of the second degree and some special examples of higher loci.

3 hrs., either half-year. First half-year, M W F, 9, 3; second half-year, M W F, 10; Tu Th S, 9, 10. Prerequisite: Course C or admission requirement 12a<sup>2</sup>.

8. Algebra.

Professor STRINGHAM,

Assistant Professors WILCZYNSKI, NOBLE, and LEHMER. Inequalities and limits, exponentials and logarithms, permutations and combinations, binomial theorem for any index, expansion of functions in series, convergency of series.

3 hrs., either half-year. First half-year, M W F, 9; Tu Th S, 9. Second half-year, M W F, 3; Tu Th S, 9. Prerequisite: Course A or admission requirement 4a.

9A. Differential Calculus.

Assistant Professor WILCZYNSKI.

The fundamental principles and formulae of the differential calculus, with applications to various problems of geometry and analysis, such as indeterminate forms, maxima and minima, expansion of functions in series, etc.

3 hrs., second half-year. M W F, 9. Prerequisite: Courses 5 and 8. Students wishing to begin the calculus in the first half-year may elect Course 4B.

UPPER DIVISION COURSES.

These courses are open to students in the Lower Division who have the necessary prerequisites.

\*9B. Integral Calculus.

Mr. ---.

The fundamental principles and formulae of the integral calculus, with applications to geometry, such as lengths of curves, areas and volumes, centers of position, etc.

3 hrs., first half-year. M W F, 9. Prerequisite: Course 9A.

11A. Determinants and Theory of Numerical Equations.

Assistant Professor LEHMER.

The theory of determinants, with applications to geometry and algebra. Transformation of equations, solution of numerical equations, elimination, symmetric functions, continued fractions.

3 hrs., first half-year. Tu Th S, 10. Prerequisite: Course 8.

\*Not to be given in 1905-06.

## 11a. Algebraic Theory of Equations.

Assistant Professor LEHMER.

The theory of equations, from the point of view of the theory of substitutions and of the theory of invariants.

3 hrs., second half-year. Tu Th S, 10. Prerequisite: Course 11a.

## 12A. Advanced Analytic Geometry.

Associate Professor HASKELL.

General properties of conic sections; introduction to the theory of higher plane curves.

3 hrs., first half-year. M W F, 10. Prerequisite: Course 5.

## 12B. Analytic Geometry of Three Dimensions.

Associate Professor HASKELL.

The elementary analytic geometry of the straight line in space, the plane, the sphere, and the conicoids, and a discussion of the theory of higher curves and surfaces, including the determination of curvature, by the methods of the differential calculus.

3 hrs., second half-year. M W F, 10. Open only to students who have taken, or are taking, Course 9A.

## 13. Synthetic Projective Geometry.

Dr. PUTNAM.

3 hrs., second half-year. M W F, 9.

## 14. Higher Plane Curves.

Associate Professor HASKELL.

Introduction to the theory of higher plane curves, with special reference to the problem of curve-tracing in Cartesian and in homogeneous coordinates.

3 hrs., second half-year. M W F, 9. Prerequisite: Course 9A.

## 16. Quaternions.

Professor STRINGHAM.

An elementary presentation of the principles of the subject, with illustrations of its application to geometry and to mechanics.

3 hrs., throughout the year. M W F, 2.

## 17. Calculus of Finite Differences.

Assistant Professor WHITNEY.

2 hrs., second half-year. Tu Th, 11. Prerequisite: Course 9B.

## 18. Logic of Mathematics.

Professor STRINGHAM.

Analysis of the foundation principles of geometry and algebra. The number-system and the vector-system of algebra compared. The geometrical theory of proportion, and the irrational. The non-Euclidean geometry. Outlines of the history of mathematical discovery, and of the development of mathematical thought, with special reference to its significance as a factor in intellectual progress.

3 hrs., throughout the year. M W F, 1. Designed especially for teachers and prospective teachers of mathematics. Prerequisite: A course in formal logic.

## 19A. Differential Equations.

Associate Professor EDWARDS.

Theory and methods of solution of ordinary differential equations, followed by a short introduction to partial differential equations.

3 hrs., first half-year. M W F, 10. Prescribed, Junior year, in the College of Mechanics.

## 19B. Differential Equations.

Associate Professor EDWARDS.

3 hrs., second half-year. M W F, 10. Elective to students who have completed Course 19A.

## 20A. Theory of Probabilities; Elementary Course.

Assistant Professor WHITNEY.

2 hrs., first half-year. Tu Th, 9. This course is prerequisite to Courses 10 and 11 in Economics.

## \*20B. Theory of Probabilities; Advanced Course.

Assistant Professor WHITNEY.

Curves of error, correlation surfaces, applications to statistical problems in Economics and Biology.

3 hrs., second half-year. M W Th, 3. Prerequisite: Course 20A and a thorough course in Calculus.

## \*23. Partial Differential Equations.

Dr. PUTNAM.

Theory of definite integrals, Fourier's Theorem and applications, introduction to harmonic functions.

3 hrs., first half-year.

## 24. Theory of Functions of a Complex Variable.

Dr. NEWKIRK.

(Introductory course). Lectures on the general theory of functions.

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

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31. Theory of Numbers. Dr. PUTNAM.  
Properties of whole numbers, both ordinary and complex, theory of congruences, residues of powers, primitive roots, quadratic forms.  
3 hrs., first half-year. M W F, 9.

## GRADUATE COURSES.

- \*15. Analytic Projective Geometry. Associate Professor HASKELL.  
The fundamental principles of projective geometry treated analytically. The principle of duality, double-ratios, involution, linear transformations of one, two, and three dimensional figures, particularly of loci of the second order and class.  
3 hrs., throughout the year. M W F, 10. Prerequisite: Courses 12A and 13.
21. Theory of Functions of Real Variables. Dr. McDONALD.  
Simple and multiple integrals; line, surface, and space integrals; Laplace's Equation and its applications; series; geometrical applications.  
3 hrs., first half-year.
- \*22. Transformation Groups and Differential Equations.  
An introduction to Lie's Theory; applications to the theory of functions, to the theory of invariants of linear differential equations, and to hydrodynamics.  
2 hrs., throughout the year.
25. Projective Differential Geometry. Assistant Professor WILCZYNSKI.  
3 hrs., throughout the year. M W F, 10.
- \*26. Absolute Geometry. Professor STRINGHAM.  
An analytical treatment of the absolute geometry of space.  
3 hrs., throughout the year. M W F, 2.
- \*27. Elliptic and Other Special Functions. Dr. McDONALD.  
A study of the principal functions of modern analysis, with reference to their practical application.  
3 hrs., throughout the year. M W F, 3. Prerequisite: Course 24.

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- \*28. Abelian Functions. Associate Professor HASKELL.  
An advanced course in the theory of functions of a complex variable, with applications to the theory of higher plane curves.  
3 hrs., throughout the year. Prerequisite: Course 24.
30. Algebraic Forms and Geometric Transformations. Associate Professor HASKELL.  
Theory of linear transformation, invariants and covariants of binary and ternary quatics. Applications to the theory of equations, and to higher plane curves. Quadratic transformations and the general theory of correspondence.  
3 hrs., throughout the year. M W F, 2.
- \*32. Theory of Finite Groups. Dr. PUTNAM.  
Substitution groups with applications to the resolution of algebraic equations; the rotation groups; introduction to the theory of abstract groups.  
3 hrs., second half-year. Tu Th, 8; Tu, 1.
33. Theory of Differential Equations. Assistant Professor NOBLE.  
3 hrs., second half-year.
38. Calculus of Variations. Assistant Professor NOBLE.  
3 hrs., first half-year. M Tu Th, 11.
40. Mathematical Seminary. Professor STRINGHAM.  
Conferences between members of the mathematical department and students engaged in higher mathematical work, for the discussion of questions related to their studies, and for the examination of recent mathematical literature; under the direction of Professor STRINGHAM. Meetings once a week. Tu, 2-4. Credit value to be determined in each case.

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