

connections with analysis"; W. Wirtinger, "Riemann's lectures upon the hypergeometric series and their significance." Of these the first and third belong to that rare and valuable class of mathematical literature which appears in some prefaces and in a few biographies, precise in statement, artistic in diction and style, broadly comprehensive, yet vividly suggestive. The others attain nearly the same degree of interest, Professor Greenhill's by its graphic mingling of experiment with theory, and Professor Wirtinger's by its lucid exposition of rich material preserved in a shorthand report of Riemann's lectures, and now brought to light after more than forty years of oblivion. After reading this and recalling the few similar events now classic, one may venture to expect that some day yet the missing manuscripts of Jacobi, alluded to by Königsberger, may be recovered.

The titles of the papers read before the six sections, nearly eighty in number, were given in the BULLETIN a year ago,* together with many abstracts and summaries. Most of them will appeal to large circles of readers; it may be permissible to mention one in particular that is universally interesting, that of Professor F. Meyer, of Königsberg, on the essential nature of mathematical proof. That there is no real increase of mathematical knowledge has been affirmed by others, but certainly not often reinforced by such a convincing series of far-reaching analyses: to the principal thesis the eloquent closing paragraph may be found to supply the needful antithesis.

H. S. WHITE.

NOTES.

THE April number (volume 7, number 2) of the *Transactions of the AMERICAN MATHEMATICAL SOCIETY* contains the following papers: "On geometries in which circles are the shortest lines," by C. E. STROMQUIST; "A generalization of the notion of angle," by G. A. BLISS; "The square root and relations of order," by O. VEULEN; "The problem of partial geodesic representation," by E. KASNER; "On the pentadeltoïd," by R. P. STEPHENS; "The groups of order p^n which contain exactly p cyclic subgroups of order p^a " by G. A. MILLER; "Groups in which a large number of operators may

* Vol. 11 (1905), pp. 205-217, and 247-263.

correspond to their inverses," by W. A. MANNING; "Finite projective geometries," by O. VEBLEN and W. H. BUSSEY; "On the analytic extension of functions defined by double power series," by W. B. FORD; "On quadratic hermitian and bilinear forms," by L. E. DICKSON; "Die kinematische Erzeugung von Minimalflächen," by P. STÄCKEL; "A fifth necessary condition for a strong extremum of the integral

$$\int_{x_0}^{x_1} F(x, y, y') dx,"$$

by O. BOLZA; "A problem in the calculus of variations in which the integrand is continuous," by G. A. BLISS and M. MASON.

THE April number (volume 7, number 3) of the *Annals of Mathematics* contains: "Introduction to the theory of Fourier's series (concluded)," by M. BÔCHER; "Note on multiply perfect numbers," by R. D. CARMICHAEL; "Note on integrating factors," by E. B. WILSON.

At the meeting of the London mathematical society held on March 8, the following papers were read: By H. LAMB, "Sommerfeld's diffraction problem and reflection by a parabolic mirror"; by L. J. ROGERS, "Function-sum theorems connected with the series

$$\sum x^n/n^2";$$

by T. J. P. A. BROMWICH, "Investigations on series of zonal harmonics"; by E. W. BARNES, "The functions $g_\beta(x, \theta)$ and $f_\beta(x, \theta)$ "; by E. J. NANSON, "Relations between the p -line determinants formable from a p by q array."

THE active participation of the members of the AMERICAN MATHEMATICAL SOCIETY in the organization of associations of teachers of mathematics is partially indicated by the following list of members who are officers of these associations in the middle west or on the Pacific coast: Professor H. C. Harvey, president, Dr. L. D. Ames, secretary, and Professor E. R. Hedrick, chairman of the executive council in the Missouri association; Professor T. E. McKinney, secretary of the Ohio association; Professor W. J. Rusk, chairman of the mathematics section of the Iowa teachers' association; Professor H. E. Slaughter, vice-president of the mathematics section of the Central association of science and mathematics teachers; Pro-

fessor G. A. Miller, president of the mathematics section of the California teachers' association ; Professor R. E. Moritz, president of the Washington state association of mathematics teachers.

THE seventy-sixth annual meeting of the British association for the advancement of science will be held at York, August 3 to 8. Professor R. LANKESTER is president of the association, and Mr. E. H. GRIFFITHS is president of section A, mathematics and physics.

THE publishing house of Gauthier-Villars in Paris announces the following books in press : J. TANNERY, *Leçons d'algèbre et d'analyse*, volume II ; P. JANET, *Leçons d'électrotechnique générale*, volume III ; E. PICARD, *Oeuvres de Charles Hermite*, volumes II and III.

UNIVERSITY OF CHICAGO.— The following advanced courses in mathematics are announced for the summer quarter, June 19 – September 1. — By Professor O. BOLZA : Elliptic functions, four hours ; Functions of a real variable, four hours. — By Professor H. MASCHKE : Projective geometry, four hours. — By Professor H. E. SLAUGHT : Elliptic integrals, four hours ; Analytic geometry, five hours. — By Professor L. E. DICKSON : Algebraic analysis, four hours ; Theory of substitutions, four hours. — By Dr. A. C. LUNN : Integral calculus, five hours ; General Seminar, two hours. — By Mr. N. J. LENNES : Pedagogy of mathematics, four hours.

YALE UNIVERSITY.— The following advanced courses are announced for the year 1906-1907. — By Professor J. PIERPONT : Advanced mechanics, two hours ; Advanced theory of functions, two hours ; Theory of functions of a real variable, two hours. — By Professor P. F. SMITH : Advanced analytic geometry, two hours ; Foundations of geometry, one hour. — By Professor H. E. HAWKES : Linear associative algebra, two hours ; Teachers course in geometry, two hours. — By Professor M. MASON : Calculus of variations, two hours ; Differential equations of physics, two hours. — By Professor E. B. WILSON : Advanced calculus, two hours ; Thermodynamics, two hours. — By Dr. W. A. GRANVILLE : Differential geometry, two hours. — By Dr. L. E. HEWES : Differential equations, one hour ; Geometric transformations, two hours. — By Mr. E. L. TAYLOR : Scientific computation, one hour. — By Professor W. B. BEEBE : Celestial mechanics, two hours. — By Professor F. E. BEACH : Vector analysis, one hour (first half year).

THE foreign universities below offer courses in advanced mathematics during the present summer semester as follows :

OXFORD UNIVERSITY (Easter and Trinity terms). — By Professor W. ESSON : Comparison of analytic and synthetic methods in the theory of conics, two hours ; Informal instruction in geometry, one hour. — By Professor E. B. ELLIOTT : Theory of functions, I, three hours. — By Professor A. E. H. LOVE : Waves and sound, two hours. — By Mr. A. L. DIXON : Calculus of variations, one hour. — By Mr. H. T. GERRANS : Line geometry, two hours. — By Mr. A. E. JOLLIFFE : Higher analytic geometry, two hours. — By Mr. P. J. KIRKBY : Plane curves, two hours. — By Mr. J. W. RUSSELL : Rigid dynamics, two hours. — By Mr. R. F. MCNEILE : Algebra, two hours. — By Mr. C. E. HASELFOOT : Series and continued fractions, two hours. — By Mr. A. L. PEDDER : Spherical trigonometry, one hour. — By Mr. C. H. SAMPSON : Solid geometry, two hours. — By Mr. C. H. THOMPSON : Differential equations, two hours.

UNIVERSITY OF PARIS. — By Professor É. PICARD : Integrals of differential equations, two hours. — By Professor E. GOURSAT : Ordinary and partial differential equations, two hours. — By Professor L. RAFFY : Applications of partial differential equations to geometry, two hours. — By Professor P. PAINLEVÉ : Analytic mechanics, two hours. — By Professor P. APPELL : Rational mechanics, two hours. — By Professor É. BOREL : Theory of integral functions, one hour. Each professor will hold a weekly conference in mathematics, assisted by Professor J. HADAMARD, Dr. E. BLUTEL and Dr. SERVANT.

UNIVERSITY OF BERLIN. — By Professor H. A. SCHWARZ : Analytic functions, four hours ; Surfaces and twisted curves, four hours ; Exercises in maxima and minima, two hours ; Colloquium, two hours ; Seminar, two hours. — By Professor G. FROBENIUS : Theory of determinants, four hours ; Seminar, two hours. — By Professor F. SCHOTTKY : Differential calculus, four hours ; Abelian and theta functions, two hours ; Seminar, three hours. — By Professor J. KNOBLAUCH : Applications of elliptic functions, four hours ; Analytic geometry, four hours ; Line congruences, one hour. — By Professor G. HETTNER : Theory of probabilities, two hours. — By Professor R. LEHMAN-FILHÉS : Analytic mechanics, four hours. — By Professor E. LANDAU : Picard's theorem, four hours. — By Dr. I. SCHUR : Integral calculus, four hours ; with exercises, one hour.

UNIVERSITY OF Breslau. — By Professor J. ROSANES : Plane analytic geometry, three hours ; Seminar, one hour. — By Professor R. STURM : Differential geometry, four hours ; Descriptive geometry, two hours ; Seminar, one hour. — By Professor A. KNESER : Integral calculus, four hours ; with exercises, two hours ; Calculus of variations, three hours ; Seminar, two hours. — By Professor G. LANDSBERG : Differential calculus, four hours ; with exercises, two hours ; Elliptic and modular functions, three hours.

UNIVERSITY OF Freiburg. — By Professor J. LÜROTH : Integral calculus, five hours ; Trigonometry, two hours ; Seminar, two hours. — By Professor L. STICKELBERGER : Analytic mechanics, five hours ; Fourier's series and integrals, two hours ; Seminar, two hours. — By Professor A. LOEWY : Theory and application of determinants, four hours ; Foundations of geometry, two hours ; Exercises in the mathematics of insurance. — By Professor J. WEINGARTEN : Selected chapters from the theory of elastic bodies, two hours. — By Dr. K. SEITH : Descriptive geometry, two hours ; with exercises.

UNIVERSITY OF GIESSEN. — By Professor M. PASCH : Algebra, four hours ; Invariants, three hours ; Seminar, one hour. — By Professor E. NETTO : Plane analytic geometry, four hours ; Definite integrals, three hours ; Seminar, one hour. — By Professor H. GRASSMANN : Analytic mechanics, I, four hours.

UNIVERSITY OF GÖTTINGEN. — By Professor F. KLEIN : Theory of functions, four hours ; Seminar (with Professors Hilbert and Minkowski), two hours. — By Professor D. HILBERT : Differential and integral calculus, four hours ; Mechanics of continua, four hours. — By Professor H. MINKOWSKI : Algebra, four hours ; Spherical harmonics, two hours. — By Professor C. RUNGE : Differential equations, six hours ; Seminar, two hours. — By L. PRANDTL : Graphical methods, two hours. — By Professor M. BRENDEL : Theory of probabilities, four hours ; Mathematics of insurance, two hours ; Seminar, two hours. — By Professor E. ZERMELO : Partial differential equations of mathematical physics, four hours. — By Dr. M. ABRAHAM : Theory of potential, four hours. — By Dr. G. HERGLOTZ : Analytic geometry, four hours. — By Dr. C. CARATHEODORY : Calculus of variations, four hours.

UNIVERSITY OF GREIFSWALD. — By Professor W. THOMÉ :

Theory of analytic functions, elliptic functions, four hours; Differential geometry, two hours; Seminar, two hours.—By Professor F. ENGEL: Analytic mechanics, I, four hours; Analytic geometry of two and three dimensions, four hours; Differential invariants, one hour; Seminar, two hours.—By Professor K. TH. VAHLEN: Integral calculus, four hours; with exercises, one hour; Determinants, one hour.

UNIVERSITY OF KIEL.—By Professor L. POCHHAMMER: Theory of determinants, four hours; Application of the calculus, four hours; Seminar, one hour.—By Professor L. HEFFTER: Differential and integral calculus, four hours; with exercises, one hour; Algebra, four hours; Applications of elliptic functions, one hour.

UNIVERSITY OF KÖNIGSBERG.—By Professor W. F. MEYER: Plane analytic geometry, three hours; Introduction to higher geometry, four hours; Seminar, two hours.—By Professor A. SCHOENFLIES: Theory of functions, five hours; Seminar, two hours.—By Professor L. SAALSCHÜTZ: Determinants, two hours; Differential calculus, four hours; with exercises, two hours.

UNIVERSITY OF MARBURG.—By Professor K. HENSEL: Theory of numbers, four hours; Differential equations, four hours; Seminar, one hour.—By Professor E. NEUMANN: Elliptic functions, four hours; Fourier's series, two hours; Seminar, two hours.—By Dr. F. v. DALWIGK: Analytic geometry, four hours.—By Dr. H. JUNG: Algebraic solution of equations, four hours.

UNIVERSITY OF MÜNSTER.—By Professor W. KILLING: Analytic geometry, I, four hours; with exercises, two hours; Seminar, one hour.—By Professor R. v. LILIENTHAL: Differential and integral calculus, four hours; Curvature of curves and surfaces, four hours.—By Professor M. DEHN: Mechanics, four hours; Analysis situs, one hour; Seminar, two hours.

UNIVERSITY OF STRASSBURG.—By Professor TH. REYE: Synthetic geometry, two hours; Mechanics, four hours; Seminar, two hours.—By Professor H. WEBER: Calculus and introduction to the theory of functions, four hours; Advanced theory of numbers, three hours; Seminar, two hours.—By Professor M. SIMON: History of mathematics in the middle ages, three hours.—By Professor J. WELLSTEIN: Introduction to

the theory of invariants, two hours ; Encyclopedia of elementary mathematics, II, three hours ; Seminar, two hours.—By Professor E. TIMERDING : Analytic geometry of space, three hours ; Applied mechanics, three hours ; Theory of probabilities, one hour.—By Professor S. EPSTEIN : Elliptic functions, two hours ; Seminar, two hours.

UNIVERSITY OF TÜBINGEN.—By Professor A. v. BRILL : Mechanics, five hours ; Foundations of geometry, three hours ; Seminar, two hours.—By Professor H. v. STAHL : Lower analysis, three hours ; Theory of functions, three hours ; Seminar, two hours.—By Professor L. MAURER : Higher analysis, I, three hours ; with exercises, two hours ; Linear differential equations, one hour.

UNIVERSITY OF BASEL.—By Professor H. KINKELIN : Applications of the calculus, three hours ; Analytic geometry, three hours ; Mathematics of insurance, one hour.—By Professor O. SPIESS : Special differential equations, three hours ; Determinants, one hour.—By Professor M. GROSSMANN : Descriptive geometry, two hours ; Non-euclidean geometry, two hours.

UNIVERSITY OF GENEVA.—By Professor C. CAILLER : Differential and integral calculus, three hours ; Rational mechanics, three hours ; Seminar, two hours.—By Professor H. FEHR : Projective and descriptive geometry, two hours ; Higher algebra, two hours ; Seminar, one hour.—By Dr. R. DE SAUSURE : Geometry of motion, two hours.

PROFESSOR D. HILBERT has been awarded the Cothenius medal of the academy of sciences at Halle.

PROFESSOR E. C. PICKERING, director of the observatory at Harvard University, has been elected a member of the Berlin academy of sciences.

PROFESSOR G. HUBER has been promoted to a full professorship of mathematics at the University of Bern, Switzerland.

PROFESSOR J. H. HAGEN, director of the observatory of the University of Georgetown, has been appointed director of the observatory of the Vatican.

DR. W. SCHLINK, of the technical school at Darmstadt, has been appointed professor of mechanics at the technical school at Braunschweig.

UPON the invitation of King Oscar, Professor V. VOLTÈRA, of the University of Rome, gave a series of lectures on the differential equations of mathematical physics at the University of Stockholm during the month of February.

DR. VANECEK has been appointed docent in mathematics at the Bohemian technical school at Prague.

DR. G. Z. GIAMBELLI has been appointed docent in projective geometry at the University of Genoa.

DR. G. DE FRANCHIS has been appointed to an associate professorship of algebra and analytic geometry at the University of Cagliari.

PROFESSOR G. FUBINI, of the University of Catania, has been transferred to the University of Genoa, as associate professor of the calculus.

PROFESSOR OSKAR BOLZA, of the University of Chicago, who is spending the year in travel and study in southern Europe and in Egypt, will resume his lectures at the university at the beginning of the summer quarter, June 19, 1906.

MR. L. A. MARTIN, JR., has been promoted to an assistant professorship of mathematics and mechanics at the Stevens Institute of Technology.

PROFESSOR E. L. RICHARDS, of Yale University, will retire from active service at the close of the present academic year.

PROFESSOR J. M. PEIRCE, Perkins professor of mathematics and astronomy and senior member of the faculty of Harvard University, died March 21, at the age of 71 years. He was appointed tutor in mathematics in 1854, university professor of mathematics in 1869, and Perkins professor of mathematics and astronomy in 1885. Professor Peirce had been a member of the AMERICAN MATHEMATICAL SOCIETY since 1898.

NEW PUBLICATIONS.

I. HIGHER MATHEMATICS.

AMODEO (F.). *Vita matematica napoletana. Studio storico, biografico, bibliografico.* Parte prima. Napoli, Giannini, 1905. 8vo. 216 pp.
L. 10.00