

theoretical discussions, and a maximum of application. It is plainly a text for students in technical courses, while its use in a more general course would hardly be recommended.

ERNEST W. PONZER.

### NOTES.

THE July number (volume 11, number 3) of the *Transactions of the American Mathematical Society* contains the following papers: "Die natürlichen Gleichungen der analytischen Curven in euclidischem Raume," by E. STUDY; "Two-dimensional chains and the associated collineations," by J. W. YOUNG; "Groups of rational transformations in a general field," by L. I. NEIKIRK; "On osculating element-bands associated with loci of surface-elements," by P. F. SMITH; "Fields of extremals in space," by G. A. BLISS, and M. MASON; "Groups generated by two operators  $s_1, s_2$  satisfying the equation  $s_1 s_2^2 = s_2 s_1^2$ ," by G. A. MILLER; "Congruences of the elliptic type," by L. P. EISENHART.

THE July number (volume 31, number 3) of the *American Journal of Mathematics* contains the following papers: "The osculants of plane rational quartic curves," by H. I. THOMSEN; "On the primitive groups of classes six and eight," by W. A. MANNING; "Minimalkurven als Oerter von Krümmungsmittelpunkten," and "Minimalcurven und Serret'sche Flächen," by E. STUDY; "On Steinerians of quartic surfaces," by J. N. VAN DER VRIES; "On the determination of the ternary modular groups," by R. L. BÖRGER; "Groups of transformations of Sylow subgroups," by G. A. MILLER.

THE concluding (July) number of volume 11 of the *Annals of Mathematics* contains: "The theory of shadow rails," by W. H. JACKSON; "On a new method of computing the roots of Bessel's functions," by W. MARSHALL; "A functional equation for the sine," by E. B. VAN VLECK; "Periodic decimal fractions," by W. H. JACKSON; "Concerning the invariant points of commutative collineations," by W. B. FITE; "A new construction for cycloids," by H. SCHAPPER; "Metric classification of conics and quadrics by means of rank," by G. RUTLEDGE; "A method of solving linear differential equations," by P. A. LAMBERT.

At the public Leibniz session of the royal Prussian academy of sciences held in Berlin on June 30 it was announced that as no competent memoir had been received, the subject announced in 1905 for which the Steiner prize was offered (BULLETIN, volume 12, page 42) is now withdrawn. The prize, of 6000 marks, was awarded to Professor GASTON DARBOUX in recognition of his contributions to the theory of surfaces.

The academy proposed the following problem for the solution of which the Steiner prize of 7000 marks will be awarded in 1914 :

“To determine all those non-degenerate surfaces of order five on which one or more series of conics lie, and to investigate their properties. It is required to confirm the correctness and completeness of the solution by furnishing an analytic commentary on the results of the geometric investigation.”

The academy also announced the following problem for the solution of which the academy's prize of 5000 marks will be awarded :

“The number of classes in the general cyclotomic field is to be determined and compared with the number of classes of its divisors.”

In both cases competing memoirs should be written in German, French, Latin, English, or Italian, and be submitted to the secretary of the academy under the usual conditions on or before December 31, 1913.

THE royal academy of sciences of Belgium announces the following prize problems for the year 1911 :

1. Develop and systematize our knowledge of the physical constitution of the sun. Prize of 800 francs.

2. Extend our knowledge of the nature of osmotic pressure. Prize of 600 francs.

3. A new contribution to the development of functions (real or analytic) in series of polynomials. Prize of 800 francs.

4. A resumé of the memoirs on systems of conics in space, together with a new contribution concerning such systems. Prize of 800 francs.

THE following courses in mathematics are announced for the winter-semester 1910-1911.

UNIVERSITY OF BERLIN. — By Professor H. A. SCHWARZ : Differential calculus, four hours ; Applications of elliptic functions, four hours ; Theory of complex numbers, two hours ;

Colloquium, two hours ; Seminar, two hours. — By Professor G. FROBENIUS : Algebra, four hours ; Seminar, two hours. — By Professor F. SCHOTTKY : General theory of functions of a complex variable, four hours ; Theory of potential in the plane and in space, four hours ; Seminar, two hours. — By Professor G. HETTNER : Infinite series, products, and continued fractions, two hours. — By Professor J. KNOBLAUCH : Determinants, four hours ; Theory of surfaces and space curves, four hours ; Mathematical exercises, one hour. — By Professor R. LEHMANN-FILHÉS : Analytic geometry, four hours ; Planetary orbits, four hours.

UNIVERSITY OF BONN.— By Professor E. STUDY : Analytic mechanics, four hours ; Seminar, two hours.— By Professor F. LONDON : Analytic geometry of the plane and of space, four hours ; Descriptive geometry, three hours ; Seminar, two hours. — By Professor F. HAUSDORFF : Differential and integral calculus, II, four hours ; Introduction to the theory of groups, two hours. — By Dr. J. MÜLLER : Theory of potential, three hours.

UNIVERSITY OF GÖTTINGEN.— By Professor F. KLEIN : Development of mathematics in the nineteenth century, four hours ; Seminar, two hours. — By Professor D. HILBERT : Mechanics, four hours ; Seminar, two hours. — By Professor E. LANDAU : Differential and integral calculus, five hours ; Seminar, two hours. — By Professor C. RUNGE : Descriptive geometry, eight hours ; Seminar, two hours. — By Professor L. PRANDTL : Aerial mechanics, four hours ; Seminar, two hours. — By Dr. P. KOEBE : Determinants and applications, two hours ; Introduction to the theory of functions, six hours. — By Dr. O. TOEPLITZ : Algebra, four hours ; Theory of sets in elementary presentation, two hours. — By Dr. F. BERNSTEIN : Elliptic functions, four hours ; Calculus of insurance, two hours. — By Dr. C. MÜLLER : History of the discovery of the calculus, two hours. — By Dr. A. HAAR : Introduction to the calculus of variations, two hours ; Theory of perturbations, two hours. — By Dr. H. WEYL : Developments in series in mathematical physics, four hours.

UNIVERSITY OF LEIPZIG.— By Professor C. NEUMANN : Selected chapters of mathematics, three hours. — By Professor O. HÖLDER : Analytic mechanics, five hours ; Theory of numbers, two hours ; Seminar, two hours. — By Professor K. ROHN :

Determinants, two hours ; Applications of the calculus to curves and surfaces, four hours ; Seminar, two hours. — By Professor G. HERGLOTZ : Differential and integral calculus, five hours ; Elements of the theory of partial differential equations, two hours ; Seminar, two hours. — By Professor H. LIEBMANN : Analytic geometry of space, five hours ; Non-euclidean geometry, two hours ; Seminar, two hours.

UNIVERSITY OF MUNICH. — By Professor F. LINDEMANN : Theory of functions of a complex variable, four hours ; Plane analytic geometry, four hours ; Introduction to the theory of groups of transformations, two hours ; Seminar, two hours. — By Professor R. v. SEELIGER : Celestial mechanics, four hours. — By Professor A. VOSS : Algebra, four hours ; Theory of differential equations, four hours ; Seminar, two hours. — By Professor A. PRINGSHEIM : Differential calculus, five hours ; Definite integrals and Fourier's series, four hours. — By Professor A. SOMMERFELD : Analytic mechanics, four hours ; Geometric optics, two hours. — By Professor L. BRUNN : Recent researches in analysis situs, two hours. — By Professor K. DOEHLEMANN : Descriptive geometry with exercises, eight hours ; Line geometry synthetically treated, four hours ; The imaginary in geometry, one hour. — By Dr. G. HARTOGS : Theory of space curves and surfaces, four hours.

UNIVERSITY OF STRASSBURG. — By Professor H. WEBER : Differential and integral calculus, four hours ; Elliptic functions, two hours ; Seminar, two hours. — By Professor F. SCHUR : Projective geometry of space, four hours ; Foundations of geometry, two hours ; Seminar, two hours. — By Professor J. WELLSTEIN : Introduction to the theory of algebraic functions, four hours ; Riemann surfaces, two hours ; Seminar, two hours. — By Professor L. v. MISES : Analytic geometry, four hours ; Kinematics of rigid bodies, two hours ; Seminar, two hours. — By Professor M. SIMON : History of mathematics, two hours. — By Professor P. EPSTEIN : Introduction to the theory of linear differential equations, two hours.

THE following advanced courses in mathematics are offered at the Italian universities during the academic year 1910–1911. Courses in algebra, analytic geometry, projective and descriptive geometry, and elementary courses in the calculus are not included :

UNIVERSITY OF BOLOGNA. — By Professor C. ARZELÀ : Lebesgue's integrals ; advanced mechanics, three hours. — By Professor L. DONATI : Electromagnetic field, principle of relativity, three hours. — By Professor L. PINCHERLE : Distributive operations, integral and differential equations (especially of the second order, in both complex and real field), three hours.

UNIVERSITY OF CATANIA. — By Professor M. DE FRANCHIS : Differential geometry with applications to non-euclidean geometry, four hours. — By Professor L. LAURICELLA : Mathematical theory of elasticity with applications, four hours. — By Professor G. PENNACCHIETTI : Principles of celestial mechanics, with applications, four hours. — By Professor C. SEVERINI : General theory of functions, four hours.

UNIVERSITY OF GENOA. — By Professor E. E. LEVI : Foundations of the theory of functions of a real variable ; calculus of variations, three hours. — By Professor G. LORIA : Theory of groups of transformations, three hours. — By Professor O. TEDONE : Special problems on equilibrium and motion of elastic bodies, three hours.

UNIVERSITY OF NAPLES. — By Professor F. AMODEO : History of mathematics before 1200, three hours. — By Professor R. MARCOLONGO : Vector analysis and its applications to hydro-mechanics, elasticity, and electro-mechanics, three hours. — By Professor D. MONTESANO : Birational correspondences in space ; geometry of straight lines and of conics as elements of space, four and one half hours. — By Professor E. PASCAL : Linear differential equations, and the theory of groups of transformations, three hours. — By Professor E. PINTO : Physical optics with special regard to the phenomena of diffraction, four and a half hours. — By Professor G. TORELLI : Analytic theory of numbers, four and a half hours.

UNIVERSITY OF PADUA. — By Professor F. D'ARCAIS : General theory of functions, elliptic functions, four hours. — By Professor U. CISOTTI : Mathematical theory of elasticity with technical applications, three hours. — By Professor A. FARABO : The teaching of mathematics in the University of Padua from the fourteenth to the seventeenth century, three hours. — By Professor P. GAZZANIGA : Theory of numbers, three hours. — By Professor T. LEVI-CIVITA : Statistical mechanics ; kinetic theory of gases, four and one half hours. —

By Professor G. RICCI: Absolute differential calculus; harmonic and poli-harmonic functions; general methods in elasticity, four hours.—By Professor F. SEVERI: Theory of algebraic functions of two variables and of their integrals, four hours.—By Professor G. VERONESE: Foundations of geometry, four hours.

UNIVERSITY OF PALERMO.—By Professor G. BAGNERA: Partial differential equations of the second order, three hours.—By Professor M. GEBBIA: Vibrations of elastic solid media; applications to acoustics and optics, four and one half hours.—By Professor G. B. GUCCIA: General theory of algebraic curves and surfaces, four and one half hours.—By Professor A. VENTURI: Planetary motion about the sun and about the center of mass; forms of planets, four and one half hours.

UNIVERSITY OF PAVIA.—By Professor E. ALMANZI: Theory of heat, three hours.—By Professor L. BERZOLARI: Geometry on an algebraic curve, three hours.—By Professor F. GERBALDI: Elliptic functions, three hours.—By Professor G. VIVANTI: General theory of functions with application to integral functions, three hours.

UNIVERSITY OF PISA.—By Professor E. BERTINI: Fundamental properties of the geometry on an algebraic surface, three hours.—By Professor L. BIANCHI: Preliminaries on ordinary and partial differential equations; infinitesimal geometry of curves and surfaces, four and one half hours.—By Professor U. DINI: Functions of a complex variable, elliptic functions, four and one half hours.—By Professor G. A. MAGGI: Equations of dynamics, potential and harmonic functions, vector fields with applications, four and one half hours.—By Professor P. PIZZETTI: Interpolation and numerical integration; notions in spherical astronomy, figure of the planets, three hours.

UNIVERSITY OF ROME.—By Professor G. BISCONCINI: Differential geometry in its connection to mechanics, three hours.—By Professor G. CASTELNUOVO: Foundations of geometry, non-euclidean geometry, three hours.—By Professor L. ORLANDO: Analytical foundation of mathematical physics, three hours.—By Professor V. VOLTERRA: General types of differential equations of mathematical physics and of celestial mechanics, three hours.—By —————: Higher analysis, three hours.

UNIVERSITY OF TURIN. — By Professor T. BOGGIO: Integral equations and theory of potential, three hours. — By Professor G. SANNIA: Non-euclidean geometry, three hours. — By Professor C. SEGRE: Geometry of birational transformations of curves and surfaces, three hours.—By Professor C. SOMIGLIANA: Theory of potential with applications, three hours. — By ———: Higher analysis, three hours.

THE following mathematicians have been elected corresponding members of the royal academy of sciences of Turin: Professor J. BOUSSINESQ, of the University of Paris, Professor E. CAVALLI, of the University of Naples, Professor V. CERULLI, of Teramo, Italy, Professor Sir G. H. DARWIN, of Cambridge University, Professor F. ENRIQUES, of the University of Bologna, Professor G. P. GUCCIA, of the University of Palermo, Professor T. LEVI-CIVITA, of the University of Padua, Professor C. NEUMANN, of the University of Leipzig. Professor M. NOETHER, of the University of Erlangen, has been elected foreign member.

AT the University College of London, Mr. F. JACKSON and Miss M. PICK have been appointed associate professors of mathematics. Mr. P. F. EVERITT has been appointed honorary associate professor of mathematics.

DR. M. PLANCHEREL has been appointed docent in mathematics at the University of Geneva.

DR. L. GABEREL, of the University of Neuchâtel, has been promoted to an associate professorship of mathematical analysis.

DR. P. FURTWÄNGLER, of the technical school at Aachen, has been appointed professor of mathematics at the agricultural institute of Bonn-Poppelsdorf.

DR. L. LICHTENSTEIN has been appointed docent in mathematics at the technical school of Berlin.

DR. E. FISHER has been promoted to an associate professorship of mathematics at the technical school of Brünn.

PROFESSOR F. HASENÖHRL has been elected corresponding member of the academy of sciences of Vienna.

PROFESSOR B. HOPKINSON has been elected a member of the royal society of London.

PROFESSOR K. VON DER MÜHLL has received the honorary degree of doctor of laws from the University of Basel.

PROFESSOR H. A. SCHWARZ, of the University of Berlin, has been decorated with the order of the red eagle of the third class with shield.

DR. C. MÜLLER, of the University of Göttingen, has been appointed professor of mathematics at the technical school of Hannover.

PROFESSOR E. STEINITZ, of the technical school at Berlin, has been appointed professor of higher mathematics at the technical school of Breslau.

DR. TH. V. KÁRMÁN has been appointed docent in mechanics at the University of Göttingen.

PROFESSOR G. LAURICELLA, of the University of Catania, has been appointed professor of mathematics at the University of Rome, as successor to the late Professor CERRUTI.

PROFESSORS E. CIANI, of the University of Genoa, B. LEVI, of the University of Cagliari, and G. FUBINI, of the technical school of Turin, have been promoted to full professorships of mathematics.

DR. L. SILLA has been appointed docent in rational mechanics at the University of Rome.

DR. C. AIMONETTI has been appointed docent in geodesy at the University of Turin.

DR. G. FORNI has been appointed docent in geodesy at the technical school of Milan.

DR. W. A. GRANVILLE, of Yale University, has been elected president of Pennsylvania College, Gettysburg, Pa.

DR. R. P. BAKER, of the University of Iowa, has been promoted to an assistant professorship of mathematics.

MISS M. B. WHITE has been appointed assistant professor of mathematics at the University of Kansas. Mr. G. W. HESS has been appointed instructor in mathematics.

PROFESSOR OSWALD VEBLEN, of Princeton University, has been promoted to a full professorship of mathematics.

PROFESSORS J. B. SHAW, of the James Milliken University, and ARNOLD EMCH, of the cantonal school of Soloturn, Switzerland, have been appointed assistant professors of mathematics at the University of Illinois.



THE following appointments to instructorships in mathematics are announced: Dr. C. D. BROOKS, at Northwestern University; Mr. B. E. CARTER, at Colby College; Mr. E. E. MOOTS, at the University of Wisconsin; Mr. C. J. WEST, at the University of Ohio; Mr. R. S. POND, at the University of Georgia.

PROFESSOR J. WEINGARTEN, of the University of Freiburg, died June 16, at the age of 74 years.

PROFESSOR J. V. SCHIAPARELLI, former director of the astronomical observatory at Milan, died July 4, at the age of 75 years.

PROFESSOR L. RAFFY, of the University of Paris, died June 9, at the age of 55 years.

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## NEW PUBLICATIONS.

### I. HIGHER MATHEMATICS.

- EPSTEIN (P.). See PASCAL (E.).
- FUCHS (C. A.) and LUDWIG (F. K.). *Zur Geometrie zweier und mehrerer Kreise.* Komotau, Benker, 1910. 8vo. 54 pp. M. 1.30
- HIME (H. W. L.). *Anharmonic coordinates.* London, Longmans, 1910. 12mo. 7s. 6d.
- LUDWIG (F. K.). See FUCHS (C. A.).
- MONTEIL (P. L.). *Théorie du point (2e partie). Géométrie curviligne.* 2e édition, revue, corrigée et considérablement simplifiée. Paris, Chapelot, 1910. 4to. 82 pp.
- MÜLLER (E.). See SCHRÖDER (E.).
- NETTO (E.). *Die Determinanten.* Leipzig, Teubner, 1910. 8vo. 6 + 129 pp. Cloth. M. 3.60
- PASCAL (E.). *Repertorium der höheren Mathematik. 2te völlig umgearbeitete Auflage der deutschen Ausgabe, herausgegeben von H. E. Timerding und P. Epstein. Band II, erste Hälfte: Grundlagen und ebene Geometrie.* Leipzig, Teubner, 1910. 8vo. 16 + 534 pp. M. 10.00
- SALMOIRAGHI (A.). *Guida pratica della geometria moderna.* Milano, Allegretti, 1910. 8vo. 24 + 120 pp. L. 5.00
- SCHIMANSKI (E.). *Die algebraischen Invarianten der projektiven Gruppen der Ebene und die geometrische Charakterisierung dieser Gruppen.* (Diss.) Königsberg, 1910. 8vo. 95 pp.