first edition of 1889, the cross-references are increased in number, some new subdivisions are introduced, and the typographical work is much improved.

This classification is prefaced by a very brief account of the work of the congress of 1889. The resolutions adopted by this congress are given in full; they explain the scope and general plan of the bibliography, which is to be by subjects in logical order and not by authors. Nothing, however, is said about the execution of the plan; nor is there any information given in this new edition as to the progress that may have been made with the work.

The permanent committee charged with the compilation of the *répertoire* is at present (February 15, 1893) constituted as follows: President, Poincaré; Secretary, d'Ocagne; Honorary Members, Prince R. Bonaparte, Prince B. Boncompagni, Darboux, Haton de la Goupillière; Members—from Austria, Em. Weyr; Belgium, Catalan, Le Paige; Denmark, Gram; France, the President of the French Mathematical Society, D. André, Fouret, Charles Henry, G. Humbert, Kœnigs, Laisant, Raffy; Germany, Lampe, Valentin; Great Britain, Glaisher, J. S. Mackay; Greece, Stephanos; Holland, Bierens de Haan, Schoute; Italy, Guccia; Norway, Holst; Portugal, G. Teixeira; Russia, Ligin; Sweden, Enestrom; United States, Craig.

NOTES.

A REGULAR meeting of the NEW YORK MATHEMATICAL SOCIETY was held Saturday afternoon, June 3, at half-past three o'clock. In the absence of the president, Professor J. M. Van Vleck occupied the chair, Mr. Charles P. Steinmetz read a paper entitled "On the flow of an incompressible liquid between coaxial cylindrical surfaces." Professor W. Woolsey Johnson communicated a paper entitled "Negative reciprocal equations" by Commander J. E. Craig, U. S. N.

Professor Van Vleck read an extract of a recent letter from Professor Felix Klein, in which Professor Klein stated that he expected to visit America during the present summer and to attend the mathematical congress at Chicago. T. S. F.

THE international congress on mathematics, astronomy, and astro-physics at Chicago will be held in the new Art Institute building on the lake front during the week beginning August 21, 1893. There seems to be every indication of a most successful session. The programme in mathematics will include a series of reviews of the recent development of particular branches of the science. Every one interested in

mathematics will appreciate the importance of attending the congress, although papers will be received from authors even when they cannot be present in person. Full abstracts of papers should be sent in advance to the secretary of the local committee, Professor G. E. Hale, Kenwood Observatory, Chicago.

PROFESSOR FELIX KLEIN of Göttingen at the request of the German government will attend the congress as the official representative of German mathematics. He will deliver several addresses, among them one on "The development of the theory of groups during the last twenty years." Professor Klein has many enthusiastic pupils, friends, and admirers in America (as everywhere), who will rejoice at the opportunity thus afforded of meeting him. He will remain in Chicago during the month of September, and will hold regular conferences with his mathematical friends and any others interested in the recent development of mathematics who may wish to attend. E. H. M.

THE course of lectures upon higher geometry delivered by Professor Klein during the winter semester of 1892–93 has been reproduced in autographic style. It makes a volume of 556 pages, and may be obtained for Mk. 7.50 (including postage), from Dr. Fr. Schilling, assistant at the royal collection of mathematical models, Göttingen.

WE are indebted to Dr. J. C. Fields for a copy of *L'Indicateur des Cours publics* of Paris for the second semester 1892–93. Among the mathematical courses announced at the *Sorbonne* are the following: Appell, Dynamics of systems; Boussinesq, Theory of the waves of oscillation; Hermite, Theory of Eulerian integrals and elliptic functions; Lippmann, Electricity; Picard, Surfaces of Riemann and abelian integrals; Poincaré, Thermodynamics; Wolf, Progress of astronomy. At the *College de France* the mathematical courses are: Deprez, Applications of thermodynamics; Jordan, Complex numbers; Koenigs, Geodesic lines; Mascart, Electricity.

THE *Grand prix des sciences mathématiques* of 1892 for the determination of the number of primes inferior to a given limit was awarded to J. Hadamard. The *Prix Bordin* offered for the application of the general theory of abelian functions to geometry was awarded to G. Humbert. The *Prix Bordin* offered for the question first proposed in 1888, to study the surfaces whose linear element can be reduced to the form

$$ds^2 = [f(u) - \phi(v)]\,(du^2 + dv^2)\,,$$

was awarded to Gabriel Kœnigs, with honorable mentions to Otto Ohnesorge and Louis Raffy.

For the grand prize of 1894 the subject of competition will be to perfect in an important point the theory of the deformation of surfaces. The *Prix Bordin* of the same year is offered for the study of those problems of mechanics which involve integrals algebraic with respect to the velocities, and, in particular, quadratic integrals.

THE Royal Academy of Belgium has announced the following subjects for its mathematical and physical prizes to be awarded in 1894 : (1) Exposition and discussion of the various theories of diffusion of one liquid into another, with new facts bearing on this; (2) Estimate of theories explaining the constitution of solutions; new experiments throwing light on the subject, and especially on the existence of hydrates in aqueous solutions; (3) The investigations of modern geometers on the theory of the triple orthogonal system to be summarized and extended in some important respect.

THE publication of a new periodical, "*L'Intermédiaire des Mathématiciens*," will be begun by Messrs. Gauthier-Villars in January, 1894. The editors will be Dr. C. A. Laisant and Mr. Émile Lemoine. The object of the journal will be to furnish information to its readers upon any mathematical question or subject in which they may be interested. A circular has been issued in which the editors ask instructors, students, and others interested in mathematics, to use it as a means of seeking any information desired, and to cooperate in the labor of answering the questions proposed. It will appear monthly. The subscription price, including postage, is six francs. T. S. F.

DR. GEORGE W. HILL has accepted an invitation from Columbia College to give a course of lectures on celestial mechanics under the auspices of the department of astronomy. The lectures will begin October 14, 1893, and will continue weekly throughout the college year. Persons desiring to attend these lectures can secure information by addressing the professor of astronomy at Columbia College. J. K. R.

THE forty-second meeting of the American Association for the Advancement of Science, which is to be held this year at Madison, Wisconsin, will take place August 17 to 24.

THE following courses in mathematics are offered to graduate students at Johns Hopkins University during the academic year 1893–94 :—Professor Craig: Theory of functions

(elementary course), twice weekly through the year; Theory of functions (advanced course), twice weekly through the year; Differential equations, twice weekly through the year; Algebraic integrals of one and two variables, three times weekly, first half-year; Elliptic functions, three times weekly, second half-year; Mathematical seminary, weekly through the year. Professor Franklin: Theory of Algebraic forms, three times weekly, first half-year; Exercises in analytical geometry of two and three dimensions, twice weekly, first half-year; Theory of numbers, three times weekly, second half-year; Theory of probability, twice weekly, second half-year. Mr. Hulburt: Theory of substitutions with applications to algebraic equations, three times weekly, first half-year; General theory of plane algebraic curves, three times weekly, second half-year.

In astronomy the courses will be as follows:—Professor Newcomb: The method of least squares, twice weekly, first half-year; Astronomical optics, twice weekly, first half-year; Advanced theoretical astronomy, twice weekly, second half-year. Dr. Poor: General course in theoretical and practical astronomy, three times weekly, through the year; Methods of computing orbits, ephemerides, and special perturbations, three times weekly through the year; Astronomical seminary, weekly through the year; Practical work with the instruments, daily through the year.

WE have to record the death of Professor Heinrich Durège at Prague on April 19 in his seventy-second year.

ON May 14, at Berlin, died Ernst Eduard Kummer, professor of mathematics in the University of Berlin, aged 84 years. T. S. F.

THE University of Chicago offers the following advanced mathematical courses during 1893–94, each being four hours a week for twelve weeks, or, if enclosed in brackets, for twenty-four weeks: Theta-functions [Functions of a complex variable] —Professor Moore. Hyperelliptic functions, Theory of substitutions [Advanced integral calculus]—Professor Bolza. Finite groups of linear substitutions, Line geometry, Geometry of surfaces, Analytical mechanics, Theory of potential, Mathematical electricity—Professor Naschke. [Determinants and advanced theory of equations]—Dr. Younge. Differential equations—Dr. Boyd.

The mathematical club and seminary hold bi-weekly meetings for the review of books and memoirs and for the presentation of the results of research. E. H. M.